THE EFFICACY OF THE LANGUAGE, LEARNING, AND LITERACY DIAGNOSTIC ASSESSMENT (L3) IN DIFFERENTIATING CHILDREN'S LANGUAGE AND LITERACY SKILLS IN PRESCHOOL THROUGH FIRST GRADE

By

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Abstract of Dissertation Presented to the Graduate School of the University of Florida in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy

THE EFFICACY OF THE LANGUAGE, LEARNING, AND LITERACY DIAGNOSTIC ASSESSMENT (L3) IN DIFFERENTIATING CHILDREN'S LANGUAGE AND LITERACY SKILLS IN PRESCHOOL THROUGH FIRST GRADE

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The National Reading Panel (NRP) was created to examine the significance of early identification and intervention for children who are at-risk for reading failure. Early intervention is the ideal mechanism for reducing the number of individuals with reading difficulty. A tool is needed that allows for a valid and reliable evaluation of a range of spoken language, written language, and speech production skills during the earliest school years to better predict later difficulty in the linguistic domain. The Language, Learning, and Literacy Diagnostic Assessment (L3) includes a case history questionnaire as well as three domains of assessment: Spoken Language, Written Language, and Speech Production. A review of the literature on spoken and written language development and the predictors of reading achievement determined the broad outline and specific subtests on the L3. The purpose of this study was to determine the efficacy of the L3 for examining and differentiating spoken language, written language, and speech production at three academic levels: preschool, kindergarten, and first grade. The participants in this study were 34 children: 10 preschool children, 11 kindergarten children, and 13 first grade children. The participants were individually administered specific subtests in each of the three domains. Results of this study revealed that the first grade group and kindergarten group performed significantly better on the Total L3 Composite, Written Language Composite, and Spoken Language Composite. The first grade group performed significantly better on the Speech Production composite than the preschool group. Based on the comparative data, it appears that the tool best differentiates preschool children from kindergarteners and first graders. This study needs to be replicated in order to test the reliability of the tool. For validation of the L3, an item analysis of each subtest must be conducted. External validity was compromised due to small sample size and limited representation of geographic regions and cultures. Speech-language pathologists should be able to make more distinct differential diagnoses using the L3.

CHAPTER 1
INTRODUCTION

In 1997 the Director of the National Institute of Child Health and Human Development (NICHD) established the National Reading Panel (NRP) to inform Congress about the status of research-based knowledge related to the effectiveness of various approaches to teaching children how to read (National Institute on Child Health, April 2000). The NRP held several regional public hearings in which teachers, parents, students, and policymakers voiced their concerns regarding the large number of children who are delayed in their acquisition of reading and spelling skills. The concern regarding the significance of early identification and intervention of children at-risk for reading failure most strongly underscores the need for a comprehensive tool to evaluate both spoken and written language skills during the earliest school years. Members of the NRP believed that many of the concerns could be addressed by completing an in-depth analysis of the effects of several areas of language instruction on the development of written language proficiency, including instruction in phonemic awareness, phonics, reading fluency, vocabulary, text comprehension, and teacher preparation for reading instruction. A number of think tanks within well-known organizations such as the Society for the Scientific Study of Reading (SSSR) and the International Dyslexia Association (IDA) have contributed empirically-based information regarding the development of early identification tools, preventative measures, and early intervention techniques. Early intervention is the ideal mechanism for reducing the number of individuals with reading difficulty. To achieve this goal, a tool is needed that allows for a valid and reliable evaluation of a range of language skills. Literacy is an outcome of the integration of listening, speaking, reading, and writing, each of which develop in a hierarchical manner within the first decade of life. Although there are many tools that evaluate key components of pre-reading and reading skills, including written language, spoken language, and speech production skills, there are two primary problems with these instruments: 1) none provide a comprehensive assessment of both spoken and written language skills and 2) the instruments have not been used by diagnosticians in the discipline of speech and language pathology to predict which children are at-risk for later reading difficulty. The efficient detection of reading disability requires a comprehensive tool that identifies differences in cohorts at various developmental levels.

The purpose of this study is to determine the efficacy of a comprehensive tool, the Language, Learning, and Literacy Diagnostic Assessment (L3), for examining and differentiating spoken language, written language, and speech production at three academic levels: preschool, kindergarten, and first grade.

The L3 measures the following three constructs: spoken language, written language, and speech production. Spoken language consists of both the comprehension and expression of various verbal language forms that are age-appropriate and consistent with the individual's sociocultural background. Written language includes both reading and writing skills. Speech production includes production of sounds in isolation, syllables, words, and sentences which are intelligible to the listener and follow the phonotactic and pragmatic constraints of the speaker's language.

Development of the L3

The Language, Learning and Literacy Assessment Instrument (L3) is an individually administered evaluation of spoken and written language for children in preschool through first grade. The instrument includes a case history questionnaire as well as three domains of assessment: Spoken Language, Written Language, and Speech Production. Questions on the case history questionnaire as well as individual subtests within each domain were selected because of their ability to distinguish between children who are developing typically relative to spoken and written language and children who are exhibiting or who are at-risk for exhibiting spoken and/or written language impairments. On the case history questionnaire, for example, parents provide information on socioeconomic status, mother's level of education, family history of reading disabilities, presence of attention deficits—factors predictive of later reading achievement (Scarborough, 1998).

All subtests included in the L3 target language skills that have been found to be strong predictors of later reading outcomes. Within the domain of spoken language, subtests target vocabulary knowledge, grammatical performance, and storytelling among other skills (Scarborough, 1998). These early spoken language skills are the best predictors of later reading achievement at school entry (Scarborough, 2001). Within the domain of written language, subtests evaluate print concepts such as letter recognition, letter naming, and concept of word; phonological awareness concepts including rhyme recognition, rhyme production, and alliteration; phonemic awareness concepts such as elision, invented spelling, and word recognition; and graphic concepts including copying geometric forms, letters, words, and sentences. With the exception of the subtests included in graphic concepts, all subtests in the written language domain have been shown to distinguish among children relative to later literacy outcomes. Finally, subtests in the domain of speech production include production of sounds in words, production of sounds in complex phrases and sentences, and nonsense word repetition. Difficulty with these tasks has been linked to later reading disabilities (Catts, Fey, Zhang, & Tomblin, 2001).

In developing the L3 the authors, Linda Lombardino, Jane Lieberman, and Jaumeiko Brown, reviewed the literature on spoken and written language development, the reciprocal influence of spoken language proficiency and early literacy knowledge, and the predictors of reading achievement. In addition the authors reviewed available assessment instruments that evaluate spoken and/or written language. Results of the reviews revealed that there is no single diagnostic instrument of spoken and written language that is sensitive to the prediction of later reading achievement based on early spoken language and literacy skills. Because early identification of children who are at-risk for spoken and written language disabilities is critical to the prevention of literacy problems and to the timely achievement of literacy skills (American Speech-Language-Hearing Association [ASHA], 2001; Justice, Invernizzi, & Meier, 2002), a tool that is capable of identifying these children is key to developing appropriate literacy-related instructional support.

A review of the literature on spoken and written language development and the predictors of reading achievement determined the broad outline and specific subtests on the L3. Test formats for specific subtests (e.g., parallel sentence production, rhyming production, nonsense word repetition) evolved out of a review of existing tools and the experimental research literature, while the inclusion of individual items depended on developmental appropriateness and, in some cases picturability. After the authors created the individual items for all subtests, they developed sample items and instructions for each subtest. Then, they consulted with graphic designers at both the University of Central Florida and the University of Florida to develop all picturable items and the L3 prototype. The first two authors, Linda Lombardino and Jane Lieberman, revised the test formats and individual items of specific subtests as well as the subtest instructions on numerous occasions following consultation with the third author, Jaumeiko Brown, and other speech-language pathologists. In making revisions, the authors considered the following issues: ease of administration, developmental appropriateness, balanced evaluation of spoken and written language, clarity of instructions, time necessary to complete evaluation, and appeal to young children. The authors based final revisions of the L3 on the results of pilot testing with three typically developing children between the ages of 5 and 7 years. Below is a more in-depth description of the three constructs examined by L3.

Spoken Language

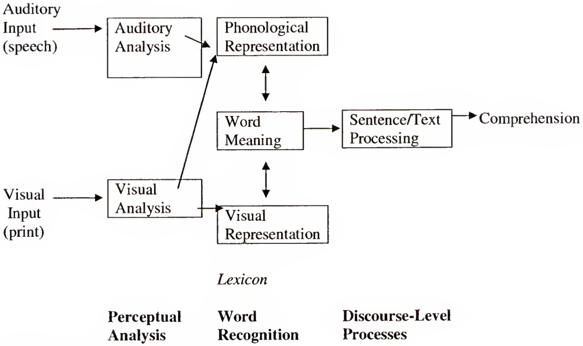
Spoken language consists of both receptive language and expressive language. Receptive language involves the comprehension of incoming spoken language, whereas expressive language involves efficient and effective production of spoken language. The components of spoken language are phonology, morphology, semantics, syntax, and pragmatics. Phonology refers to the sounds in a particular language and the rules which govern the combination of those particular sounds (i.e., phonotactics). Morphology involves the structure of words and the construction of words from the smallest unit of meaning (i.e., morphemes). Semantics refers to the meaning of words in isolation and when combined in phrases and sentences. Syntax involves the rules for combination and order of words into sentences. Pragmatics entails the rules governing the use of language in social contexts (Roth & Worthington, 2001). Bloom and Lahey (1978) placed each of the subsystems into one of the following domains: content, form, and use. *Content* is composed of lexical and semantic concepts; *form* includes phonology, morphology, and syntax; and *use* includes pragmatic functions and conversational devices. When considering these subsystems of language, Bloom and Lahey (1978) defined language as a code in which ideas about the world are expressed through a conventional system of arbitrary signals for communication. When analyzing language development and disorders, both the receptive and expressive language processes are assessed.

Language development begins in-utero as evidenced by a child's ability to recognize a mother's voice postnatally (De Casper & Spence, 1985; Owens, 1996). This recognition requires attention to and memory of the mother's voice, both key components in receptive language development. A child's knowledge of words begins before the child can communicate verbally as evidenced by the child's ability to use conventional gestures such as pointing, showing, and sharing to request or comment before s/he is able to perform similar functions with speech (Bates, Camaioni, Volterra, 1976). By the time a child is five-years-old, s/he has an expressive vocabulary of approximately 2100 to 2200 words (Owens, 1996; Roth & Worthington, 2001). Bloom (1988) defines a language disorder as any disruption in the learning or use of one's native language as evidenced by language behaviors that are different from those expected for the child's age and socio-cultural environment and that interfere with the communicative interaction between the child and members of his community. Some indicators of language disorder are slow or delayed onset of language, limited use of semantically and syntactically accurate language, difficulty learning grammatical morphemes, limited use of sentences, inappropriate use of language, and difficulty understanding spoken language (Hedge, 1996). One of the key indicators of language delay or language disorder is late-talking. Rescorla and Alley (2001) noted that the most commonly cited concern by parents when bringing their children in for a developmental evaluation is expressive language delay. Paul (1996) found that children who had small vocabularies as toddlers demonstrated language deficits throughout the preschool period. Language production, including phonology, syntax, and narrative skills, was found to be the area of greatest concern in the preschool population. By school age, however, the majority of these children performed within the normal range for expressive language. In a follow-up study, Rescorla (2002) found that children diagnosed as late-talkers between the ages of 24 and 31 months had significantly poorer scores on most language tasks through age nine. She proposed that late-talkers are a subset of children with a specific language impairment (SLI). SLI is a classification given to a heterogenous group of language disorders that are idiopathic in nature and manifest in difficulty learning language that is not a consequence of intellectual, sensory, or emotional problems (Bloom, 1988; Leonard, 1998). In a recent study, Tomblin et al. (1997) reported that the prevalence estimate for boys with SLI was 8% and for girls, 6%, with an overall prevalence rate of 7.4%. Children at risk for SLI may be identified before the age of three as they tend to be late in acquiring single words and early syntactic constructions (Tager-Flusberg & Cooper, 1999). Stothard, Snowling, Bishop, Chipchase, and Kaplan (1998) found that children with normalized language who were diagnosed early with SLI due to difficulty with phonology and syntax production continue to be at-risk for persistent communicative difficulties if they have difficulty retelling narratives. In addition, difficulty with the use of several finite verb-related morphemes in obligatory contexts and nonword repetition tend to distinguish children with SLI from their typically developing peers (Tager-Flusberg & Cooper, 1999). Bishop and Adams (1990) reported that syntactic skills during the preschool years accounted for a substantial proportion of the variance in later literacy attainments after allowing for the contribution of non-verbal ability. Overall, Bishop and Adams (1990) found that children diagnosed with SLI at five-and-a-half years of age who retained their language difficulties at eight-and-a-half years of age also had difficulty reading. Paul and Murray (1997) reported that a population of children in second grade with slow expressive language development (SELD) presented with language and metaphonological skills within the average range. Though Paul and Murray's (1997) findings seem contrary to Bishop and Adams' (1990) results, Paul and Murray (1997) state that success with verbal and literacy skills in first and second grade is dependent upon low level skills such as phonics and sight word recognition. Children in these grades have not yet reached Chall's (1983) "reading to learn" stage which requires higher order thinking skills. Thus, it appears that some preschool children with spoken language difficulty that do not appear to persist into the later school years experience an *illusive recovery* (Scarborough & Dobrich, 1990) with the symptoms of the disability evolving into impaired reading and spelling acquisition or inefficient use or understanding of higher order thinking skills around third grade (Bishop & Adams, 1990). Children initially diagnosed with SLI whose language difficulties appear to have resolved were found to perform similarly to control groups on most tests of spoken and written language with the exception of tasks which tested verbal short-term memory and phonological skills (Stothard et al., 1998). These results indicate that these children have processing deficits in areas that support literacy skills that manifest once reading proficiency becomes an academic requirement (Stothard et al., 1998). Stothard and colleagues (1998) found that children who continue to present with spoken language deficits at age 5:6 are at-risk for persistent spoken language impairments as well as reading and spelling deficits. Finally Boudreau and Hedberg (1999) found that many young children with SLI have difficulty on tasks measuring word rhyming, letter naming, and association of spoken words with their written counterparts. Although children with SLI and children with a specific reading disability present with similar behavioral characteristics (e.g., verbal working memory deficits, morphological errors, etc.), research indicates that they are two distinct disorders (Snowling, Bishop, & Stothard, 2000). The relationship between spoken language and written language is discussed below.

Written Language

The relationship between spoken language and written language is bidirectional, with spoken language difficulty being both a cause and consequence of literacy problems (ASHA, 2001). Lombardino, Riccio, Hynd, and Pinheiro (1997) found that children with reading disabilities showed relatively depressed scores on measures of expressive language and phonemic processing when compared to a peer group of children with attention deficit disorder. Similarly, Catts et al. (1999) and other researchers have found that many children with reading disorders have concomitant difficulties with spoken language or have a history of resolved speech and/or language deficits. Additionally, language therapy targeting vocabulary enhancement, morphological structures, sentence structure, and pragmatics has been found to facilitate reading efficiency (ASHA, 2001). Listening comprehension is thought to be related to reading comprehension in that both require storage and retrieval of linguistic information. Morais (1991) posits that written language represents spoken language on some fundamental level and that mastery of the alphabetic system involves both explicit and implicit correspondences with speech. The following is an interactive, parallel processing model developed by Kamhi and Catts (1999) which compares the processes and knowledge involved in understanding written and spoken language. The critical role of phonological representations in both the written and spoken language modalities is underscored in this model. Both speech and print access phonological representations which are matched with word meanings and processed in context, allowing for accurate comprehension.

The components of written language, like spoken language, are phonology, morphology, semantics, syntax, and pragmatics. Written language, however, is a more complete symbolic system because it requires the processes of rapid decoding and word recognition of print that is then integrated with semantic concepts to achieve comprehension. Additionally, written language involves spelling, a process of encoding that is difficult in irregular orthographies such as English. The systematic relationships between speech and print, while inherent to the process of reading, are complex which may explain why alphabetic orthographies may be difficult to grasp for some children (Liberman & Shankweiler, 1979).



Taken from Kamhi and Catts, p. 6.

Reading is defined by Orton (1994) as a primarily language-receptive process in which the printed word, a visual stimulus, arouses the auditory memory of the sound pattern of the spoken word along with recognition of its meaning. Gough and Tunmer (1986) proposed a simple view of reading (R) which describes basic relationships between decoding (D) and comprehension (C) (D +C =R). Based on this view, reading is the process of decoding and comprehending text. Other researchers have developed more comprehensive theories of reading acquisition which can be generally categorized as either developmental (e.g., Chall, 1983; Ehri, 1992; Frith, 1985) or interactive (Baron, 1977; Barron, 1981, 1986; Baron & Treiman, 1980; Seidenberg & McClelland, 1989) models of reading.

As stated earlier, Gough and Tunmer's (1986) simple view of reading indicates that reading is the product of adequate decoding and comprehension skills. From this simple view of reading, Gough and Tunmer (1986) devised a classification system for describing different forms of reading profiles which included the following: 1) Children who are precocious readers or read at an age-appropriate level have adequate or above average word decoding/word recognition skills and adequate or above average reading comprehension; 2) Children who have developmental dyslexia are characterized by depressed word decoding/word recognition skills but relatively unimpaired reading comprehension; 3) Children who have hyperlexia with above average word recognition and depressed reading comprehension, and 4) Children described as "garden-variety readers" who have depressed word decoding/word recognition and reading comprehension skills. Reading disorders manifest as early as age three in the case of hyperlexia and as late as third grade in the case of children who are garden-variety readers. Of these three types of reading disorders, developmental dyslexia and garden-variety readers are the most commonly described and studied.

Garden-variety readers represent the largest proportion of students described as “learning-disabled” and “slow learners” (Goldsworthy, 1996). Goldsworthy (1996) stated that the reading performance of garden-variety readers is often commensurate with their mental ability and that their reading difficulty reflects their depressed cognitive ability.

Developmental dyslexia is the most prevalent specific learning disability and is characterized by a discrepancy between intelligence and reading aptitude (Lyon, 1995). For some children with developmental dyslexia, however, an insufficient discrepancy between intelligence and reading prevents an accurate diagnosis. However, several authors have argued against the use of intelligence testing as a benchmark for defining dyslexia (Siegel, 2001; Stanovich 1992) because intelligence tests often require the type of language processing that is deficient in persons with dyslexia, thereby concealing the "real" aptitude of these children, and degree of reading aptitude and intelligence do not differentiate poor readers with and without discrepancies on skills of phonological awareness, word reading, and verbal short-term memory.

Spelling is a more complex component of written language and requires encoding, the process of matching sounds and sound patterns to the orthographic representations of these sounds. Encoding involves segmenting sounds in words, translating phonemes into corresponding graphemes, and then blending these constituents parts in a printed word (Gillingham & Stillman, 1997). Treiman and Bourassa (2000) described spelling as a process of symbolizing the linguistic structure of spoken words. When children learn that alphabetic writing represents the sounds of language, they begin to learn sound-letter combinations for spelling (Treiman & Bourassa, 2000). Initial attempts to represent sounds in print is referred to as "invented spelling." Invented spelling occurs when a person uses his/her knowledge of letter names, letter sounds, and print conventions to create a word in print (Read, 1975). Invented spelling is a prereading skill that occurs before any formal training in reading and/or writing and is it highly correlated with reading success and developmental patterns that parallel spoken language patterns in preschool children (Ahmed & Lombardino, 2000). For example, consonant cluster reduction, a common phonological pattern in the speech of young children is also observed in their early spellings. The relationship between reading and spelling is bidirectional. In fact, Ehri (2000) found that reading allows readers to retain word-specific images in memory, which facilitates spelling. Children with strong invented spelling skills tend to be more familiar with the alphabetic principle, the underpinning of proficient reading (Adams, 1990; Ehri, 2000).

Developmental Models of Reading Acquisition

Chall (1983), Frith (1985), and Ehri (1991) among others have proposed stages of reading development. These models are developmental in nature and attempt to show parallels in the acquisition of reading and spelling. Chall's (1983) stage model begins with "prereading" in which the child accumulates knowledge about print and books from the surrounding environment. Chall (1983) does not consider this as the initial stage, but rather as an acknowledgement that emergent literacy skills precede conventional reading skills. In the next stage, entitled "initial reading", associations between graphemes and phonemes are learned. Chall's (1983) "ungluing from print" stage is a transition from decoding words to recognizing familiar words "by sight." In her "learning to read" stage, word recognition becomes more automatic with the emphasis changing from word decoding and recognition to reading comprehension skills. Her last two stages, "multiple viewpoints" and "construction and reconstruction", highlight the use of higher order thinking skills to facilitate understanding of abstract concepts such as learning to deal with more than one point of view and gaining knowledge through reasoning.

Frith's (1985) model consists of three stages, logographic, alphabetic, and orthographic, that describe the development of reading and spelling in a staggered step progression. In reading, the logographic stage involves immediate recognition of a word or words within a familiar context and/or background. The child remembers words by features such as first letter or word length (graphic cues). This stage is not represented in spelling because spelling requires some knowledge of sound-letter correspondences.

During the alphabetic stage, children realize that a relationship exists between a spoken word (phonemes) and its spelling (graphemes). The "alphabetic principle" is the foundation for learning to read (Adams, 1990). In the final orthographic stage, children develop the ability to rapidly read words by processing large units of print at the syllabic and/or morphemic levels (e.g., *tion* in print is always pronounced *shun*) allowing for more fluent and automatic word recognition. Orthographic knowledge is first observed in reading and later seen in spelling patterns. Hence, the spelling of irregular words, especially with multiple syllables, is one of the most difficult challenges in literacy acquisition.

Ehri's (1991) stage model, a simplification of Chall's (1983) older model, consists of four stages: prereading or emergent reading; initial reading or decoding; fluency; and reading to learn. Ehri's (1991) initial reading stage involves detecting and segmenting words into phonemes. During the fluency stage, the child reads with greater speed and less effort, allowing reading to be coordinated with comprehension through efficient connections between visual images and pronuncations. In the last stage, reading to learn, reading vocabulary increases as the child learns new content through reading (Ehri, 1991).

Though researchers use different terms to describe each stage, there is a noticeable overlap in the characteristics of each model which marks the transition into later stages. For example, both Ehri's (1991) initial reading and Frith's (1985) alphabetic stage describe the child as using graphophonemic rules to decode words. In addition, each of the final stages posits that a child's lexical access skills are more automatic, a process necessary for efficient reading comprehension. Chall's (1983) and Ehri's (1991) models underscore the relationship between automaticity of word recognition and comprehension of text.

These developmental models, however, do not account for the interactive processes that allow for multiple domains of language to interact in order to identify words, access meaning, and comprehend the meaning in context. The interactive and connectionist models addressed below attempt to show how interconnections between and among processing mechanisms work in concert to allow for efficient and accurate reading.

Interactive Models of Reading Acquisition

Interactive models of reading describe the processes involved in achieving meaning from print. These models posit that information processing skills necessary for reading occur in a top-down processing manner, a bottom-up processing manner, or a parallel processing manner.

The top-down processing model underlies the paradigm upon which the whole language reading approach is based. Spafford and Grosser (1996) emphasize that in top-down processing the reader begins with schema-based comprehension as s/he is reading for meaning and that the construction of meaning occurs as the reader interacts with the text. This is followed by the reader's knowledge of sentence structures and use of context, whole word recognition techniques, and finally phonics skills for unfamiliar decodable words (Spafford & Grosser, 1996). Church, Fessler, and Bender (1998) stated that efficient readers use past experiences and information garnered from the text while applying what they know about the phonemic-graphemic, syntactic, and semantic features of language necessary to accurately access meaning.

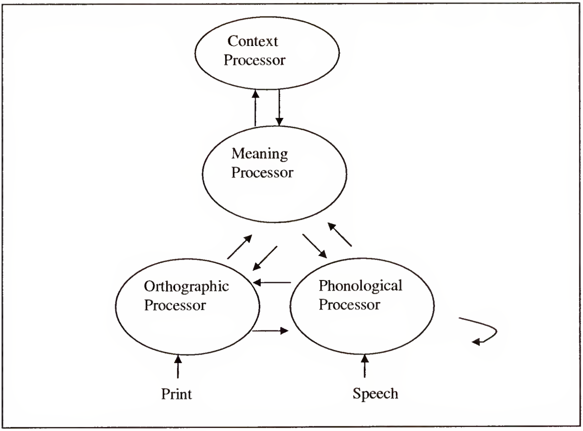
In a contrasting perspective, the bottom-up processing model describes reading as a hierarchy of skills which progress from knowledge of the "alphabetic principle" (i.e., graphophonemic associations) to knowledge of decoding words in phrases, sentences, and paragraphs (Church, Fessler, & Bender, 1998). Automaticity is inherent in this model because as the reader becomes familiar with the base skills, s/he is more able to access those skills rapidly (Church, Fessler, & Bender, 1998). The general hierarchy of bottom-up processing involves letter recognition, phonological skills, word-level phonic skills, sentence-level skills, text-level reading, comprehension skills (Spafford & Grosser, 1996).

The dual-route theory posits that reading is accomplished using one of two routes, the lexical route or the phonological route (Baron, 1977; Barron, 1981, 1986; Baron & Treiman, 1980). This theory is based on the assumption that these two routes operate independently of one another. Using the lexical route, reading occurs when associations are made between the visual form of the word stored in memory and its meaning without the necessity of accessing phonological representations. Proponents of this model note that children learn these associations through repetition and rote memory. Further, automaticity is inherent in lexical route processing. Gillingham and Stillman (1997) defined automaticity as the automatic and correct responses to linguistic stimuli without conscious effort. Without automaticity, reading would lack fluency and reading comprehension would be impaired (Church, Fessler, & Bender, 1998. The lexical route includes aspects of the top-down processing model, which is based on the premise that reading efficiency is more closely linked to the meaning rather than to the pronunciation patterns of words.

The phonological route is based on a bottom-up information processing model. The bottom-up model suggests that a part to whole hierarchy exists as words are processed at the sound-letter level (decoding) prior to the accessing of word meanings (Church, Fessler, & Bender, 1998). Because sounds in words must be accessed first, retrieving the meaning of a word takes longer through the phonological than visual route. While the dual-route theory posits that the phonological and visual routes function independently of one another, conflicting hypotheses suggesting that phonological decoding and sight word recognition occur concurrently suggest an interaction between the visual and phonological routes (Ehri, 1992).

Ehri's (1992) amalgamation model integrates the two components of the dual-route theory. She proposes that systematic visual-phonological connections are established between the spelling of words and their pronunciations in memory. Upon seeing a word for the first time, a reader applies phonological recoding skills. After having read the word a number of times, the reader is able to quickly identify the word because the *spelling of the word is linked to the pronunciation(s) of the word and is retained in memory as an orthographic image* (Ehri, 1992). Amalgamated representations appear to be the basis for efficient and rapid simultaneous access to the pronunciation and the meaning of a word (Tunmer & Hoover, 1992).

Seidenberg and McClelland (1989) suggested an even more comprehensive model in which several processors needed for reading work in concert. Seidenberg and McClelland's (1989) connectionist model consists of four processors: orthographic, phonological, semantic, and context. Their connectionist model integrates both top-down and bottom-up processing. The *orthographic processor* is used to recognize words and the sequence of letters within the word. The *phonological processor* then maps the sounds onto the letters within the word. Adams' (1990) modification of Seidenberg and McClelland's (1989) model, which is shown below, suggests that as graphemes are being processed, the phonemic component facilitates comprehension of the text. The *semantic processor* assigns meaning to the specific word, and the *context processor* refines the meaning of the word depending upon the other words in the text and the relationship of the words to the reader's knowledge of the content. The strength of the relationships between the processors appears to relate to the degree of exposure to literacy. The greater one's exposure to sequences of letters, the greater the strength of neural connections among the orthographic, phonological, and semantic processors. Researchers posit that there are two primary reasons why weak connections result in reading disabilities. In one case, a lack of exposure to literacy diminishes the development of these connections and results in depressed word recognition and word decoding skills. In other cases, such as with persons who have developmental dyslexia, "differences" in the neurobiology of their systems (e.g, atypical patterns of cell migration during gestation) predispose them to have weak phoneme-grapheme connections in spite of often intensive instruction in sound-letter correspondences (Pugh et al., 1996; Leonard et al., 2001). Errors in any of the processors are theorized to result in a variety of spoken and written language learning disabilities.



Taken from Adams, pp. 22.

Relationship between Phonological Knowledge and Reading

Metalinguistics is the ability to reflect upon and manipulate the structural features of language (Bishop & Adams, 1990). The term 'metalinguistic' is used frequently in the literature to describe children's awareness of language as an object in itself. Tunmer and Rohl (1991) categorized metalinguistics into four general areas: phonological awareness, word awareness, syntactic awareness, and pragmatic awareness. Phonological processing is a mental operation involving specific components necessary for analyzing the complex acoustic wave forms of speech (Tallal, Miller, Jenkins, & Merzenich, 1997). These acoustic wave forms of speech are the phonological or sound structure of spoken language used in decoding written language (Torgesen, Wagner, and Rashotte, 1994). In contemporary literature, the components of phonological processing are referred to as phonological awareness, phonological retrieval, phonological memory, and phonological production skills (Catts & Kamhi, 1999; Torgesen, Wagner, & Rashotte, 1994).

Phonological awareness is sensitivity to, or explicit awareness of, the phonological structure of spoken language (Torgesen, Wagner, & Rashotte, 1994). It encompasses the ability to manipulate and use the sounds and words in one's native language (Tunmer & Rohl, 1991) whether presented in a spoken or written form. Phonological awareness skills consist of rhyme identification and generation (e.g., Give me a word that rhymes with 'cat'?), syllable blending and segmenting (What word do you get when you put these two words together: 'row' and 'bot'?), onset and rime blending and segmenting (e.g., What is the first sound in 'cat'?), and phoneme manipulation (Tell me the sounds in the word 'cat'?). Paul and Murray's (1997) analysis of studies assessing the hierarchy of phonological awareness skills revealed that children are first observed to show skill in identifying rhymes followed by matching syllables, matching onsets, counting segments within words, manipulating the order of segments within words, and finally deleting segments within words.

Phonological awareness in speech is highly correlated with later reading ability (Badian, 1998) and phonological awareness in print (i.e. sounding out a nonsense word) is a phonics skill essential for learning alphabetic orthograhies. Orton (1994) defined phonics as a guide to an alphabetic system of transcription which highlights the letter-sound correspondences used when reading and writing text (Gillingham & Stillman, 1997). Various studies have indicated that children who performed well on phoneme-counting tasks had difficulty with nonsense word decoding tasks; however, no children who performed poorly on phoneme-counting tasks performed well on a nonword decoding task (Juel, Griffith, & Gough, 1986; Tunmer & Nesdale, 1985). The relationship between reading and phonological awareness is linked to knowledge of graphophonemic correspondences which are necessary for segmentation of spoken words into their phonemic elements (Tunmer & Rohl, 1991). It appears that the general relationship between reading and phonological awareness is bidirectional, with early levels of phonological awareness facilitating later reading, and then reading facilitating the acquisition of more complex phonological awareness skills (Tunmer & Rohl, 1991) such as phoneme reversal. Phonological awareness is necessary but not sufficient for efficient reading as spoken language skills for word meaning and syntactic structures are central to the understanding of text (ASHA, 2001).

Children with adequate phonological awareness skills have been found to acquire phonics skills more quickly and use those skills more effectively (Catts & Kamhi, 1999). A plethora of studies such as the one conducted by Torgesen, Wagner, and Rashotte (1994) indicate that performance on phonological awareness tasks in kindergarten is a strong predictor of later reading skills. Torgesen, Wagner, and Rashotte's (1999) data from a longitudinal study indicate that phonological awareness uniquely predicts nonword reading with letter knowledge being a unique predictor of word reading and rapid automatized naming. Additionally, many children with reading difficulty have impaired phonological awareness skills (Catts, Fey, Zhang, & Tomblin, 1999).

Phonological working memory refers to the immediate, verbatim, and structured recall of recently encountered verbal representations (Gillam & van Kleeck, 1998; Torgesen, Wagner, & Rashotte, 1994). This process is most often tested on tasks of short-term or working memory such as repeating a series of unrelated words, repeating nonsense words, and repeating a series of digits. Cowan (1998) defined short-term memory as a vivid form of memory that lasts for only a few seconds after receiving a stimulus, whereas working memory is considered a form of short-term memory which is used to solve a problem or perform a task. Cowan (1998) suggested that learning a new word requires retention of the phonemic sequence in short-term memory for a duration that allows sufficient detail to become embedded in long-term memory. Cowan (1998) posited that efficient verbal short-term memory occurs when the articulatory loop functions appropriately. The articulatory loop is comprised of a phonological buffer which stores information temporarily and a central executive mechanism which is thought to determine where each specific type of information should be placed either temporarily or permanently (Cowan, 1998). The phonological representations for linguistic stimuli are thought to be established via this mechanism. It has been argued that the integrity of the phonological representations affect reading ability (Torgesen, Wagner, & Rashotte, 1994). Phonological coding and phonological recoding are the two primary processes thought to underlie phonological working memory (Gillam & van Kleeck, 1996). Phonological coding occurs when acoustic information is translated into a fixed phonological representation (Gillam & van Kleeck, 1996). A person's ability to perform a phonological segmentation task requires accessing the appropriate phonological representations, holding them in phonological working memory, and then manipulating the specific sounds. Other auditory linguistic tasks such as sentence repetition and story recall tasks are good predictors of reading skill because they require adequate verbal working memory (Badian, 1998). Phonological recoding is a working memory process in which orthographic information is translated into phonological representations (Gillam & van Kleeck, 1996). Whether *sounding out* words or accessing them via *sight word reading*, it is thought that after the orthographic representation of a word has been analyzed then the corresponding phonological representation is accessed to determine how to pronounce the target word (Adams, 1990; Gillam & van Kleeck, 1996).

Phonological retrieval refers to the ability to easily and quickly access phonological information from long-term memory (Torgesen, Wagner, & Rashotte, 1994). Children with reading deficits often have word finding difficulties which are evidenced in serial automatized naming tasks (rapid automatized naming) and confrontation picture naming tasks (Catts & Kamhi, 1999). Rapid automatized naming has been found to be predictive of orthographic processing and reading fluency ability (Bowers, Sunseth, & Golden, 1999).

Phonological production refers to speech production of simple and complex syllables, real words and nonwords in isolation, phrases, and sentences (Catts & Kamhi, 1999). Production relies on phonological memory for accurate phonological representation of the sounds in a word. Catts (1989) found that children with reading difficulty were more likely to mispronounce multisyllabic pseudowords. Pseudoword repetition requires immediate recall of a lexical item with no semantic component in phonological memory. Thus, if children with reading difficulty are unable to form adequate and easily retrievable graphophonemic representations, then deficits in phonological memory are implicated. Catts (1986) found that errors in the production of multisyllabic words by persons with dyslexia were generally word-specific substitutions or deletions of sound segments. He posited that this error pattern might reflect difficulties in encoding phonological information in memory with inefficient development of phonological representations preventing storage of necessary phonological information. Additionally, Catts (1986) noted that some errors made by the subjects with dyslexia could not be explained on the basis of inaccurate phonological representations. For instance, frequent errors occurred in the production of phrases containing common monosyllabic words likely to be accurately represented by the control subjects (Catts, 1986). Catts (1986) explanation for this phenomena was that underlying difficulties in the process of articulating and/or planning speech sound sequences might account for the problems dyslexic subjects had in the speech production of phrases. Relationships between speech production of complex syllable structure and language skills are addressed in the next section.

In summary, all domains of phonological processing as defined by Wagner and Torgesen (1987) and Torgesen, Wagner, & Rashotte (1994) appear to be critical for reading acquisition and reading competence. In fact, Scarborough (1998) reported that measuring verbal working memory, rapid automatized naming, letter identification, letter sound knowledge, and phonological awareness skills in combination predicted the presence or absence of a reading disability with 90 percent accuracy.

Speech Production

Speech production is a motor skill that requires the articulators to move in a rapid and skilled manner (Bleile, 1995) to produce lexical representations that are consistent with the phonological constraints of the language. Speech production requires speech motor learning which occurs when an increase in the speed of speech production occurs concomitantly with an increase in the accuracy of the speech output (Sanes, Dimitrov, &

Hallet, 1990). Speech motor development involves perceptual, cognitive, and motor factors (Oller & MacNeilage, 1981). Assuming that neurological and physiological functions for speech production are unimpaired, children begin to vocalize for nonreferential purposes at birth (Bleile, 1995). These nonreferential vocalizations include cooing and babbling (Bleile, 1995). Vowels, nasals, stops, and glides are the earliest speech sounds to appear with vowel production occurring first. Typically, a child's expressive vocabulary contains words composed of sounds in the child's developing speech repertoire. Stampe (1969) described the simplification processes used by normally developing children that conform to the limitations of their developing speech mechanisms as the theory of natural phonological processes. Reduction of consonant clusters, deletion of final consonants, assimilation of the phonetic features of one syllable to other syllables are exemplars of a few of these simplification processes (Oller & McNeilage, 1981). When sound errors or simplification patterns are produced beyond the typical age, however, then an organic or functional articulation disorder is present. Among some clinicians in the field, the distinction between an organic and functional articulation disorder is not made. In fact, many researchers use the terms interchangeably. Though they can co-occur in an individual, they are separate disorders (Bleile, 1995). An organic articulation disorder (Roth & Worthington, 2001), often referred to simply as an articulation disorder, is a speech production deficit resulting from a physiological deviation. More specifically, a person with a cleft palate, submucous cleft, enlarged palatine tonsils, hypertrophied adenoids, edema in the vocal folds, or any other orofacial anomaly who has a speech production deficit related to a structural deviation is said to have an organic articulation disorder (Gierut, 1998).

A functional articulation disorder is another name for a phonological disorder (Bleile, 1995; Roth & Worthington, 2001). The National Institute on Deafness and Other Communication Disorders (1994) reported that approximately 10% of preschool and school-age children present with a phonological disorder. A phonological disorder is present when speech production deficits are present in the absence of structural anomalies (Roth & Worthington, 2001). Children with phonological disorders have adequate visual and hearing acuity, normal intellectual abilities, and no signs of significant structural abnormalities or neurological dysfunction (Roth & Worthington, 2001). Phonological disorders are language-based speech disorders (Bleile, 1995) with the child systematically substituting, omitting, or adding a specific sound or sounds (e.g., fronting, depalatization, etc.). Because many of the studies reviewed did not differentiate between an organic and a functional articulation disorder, data reported are often from both populations.

Shriberg and Kwiatkowski (1994) analyzed numerous studies which revealed that a notable number of individuals with functional articulation impairments often have spoken language deficits as well, particularly in syntax. As mentioned earlier, speech production plays an important role in phonological processing because the production of complex speech patterns (Catts, 1986) or multisyllabic words (Catts, 1989) is contingent upon adequate physiological and cognitive mechanisms (e.g., the ability to create adequate phonological representations). Bishop and Adams (1990) found that children who produced less than 70% of the consonants correctly at five-and-a-half years of age showed wide-ranging deficits in syntax and semantics. Bishop and Adams (1990) hypothesized that reading development will be affected if an expressive language impairment is still present or if an expressive phonological impairment occurs in the context of other language deficits.

Larivee and Catts (1999) noted that children with a phonological disorder appear at-risk for delayed or impaired reading acquisition, because they show delayed development in the production of the sound system of the language. Webster and Plante's (1997) findings suggest that children with phonological disorders have an overt developmental phonologic impairment which may delay the establishment of secure, stable phonological representations. These weak phonological representations are thought to hinder phonological processing (i.e., phonological awareness, verbal short-term memory, and word retrieval) which in-turn affects reading acquisition (Webster & Plante, 1997). Retrospective studies indicate that adults diagnosed and treated for phonological disorders in childhood continue to have difficulties in the retrieval, manipulation, and comprehension of linguistic information (Felsenfeld, McGue, & Broen, 1995), all important in the process of accurate and automatic reading.

When reviewing the symptoms of a language, reading, or speech production disorder and the intervention methodologies, there is a remarkable overlap. It is the potential interrelationship among these areas that underscores the need for an integrated tool.

Rationale for an Integrated Tool

The literacy mandates set forth by Congress in 1997 resulting in the National Reading Panel and the Reading First Initiative supported by George W. Bush in 2001 along with many other early reading initiatives, indicate that literacy is a priority in this country. The fact that children are failing to meet the expectations of literacy competence (National Reading Panel, April 2000) also substantiates the need for reliable and valid measures of reading and related skills.

Literacy is composed of listening, speaking, reading, and writing. The components of literacy are hierarchical with listening being the first aspect to impact on cognition and language development, and adequate writing ability resulting from other relatively intact and functioning components of literacy, however, the components work in conjunction with each other. Spoken language consists of listening and speaking. Written language is composed of reading and writing. Speech production has been found to assist with reading efficiency, listening skills, and writing when acting as a feedback mechanism. Spoken language and written language have reciprocal relationships with proficiency in one area providing a means for improvement in the other area (ASHA, 2001). Gillingham and Stillman (1997) reported that children who experience reading failure also have difficulty learning new vocabulary, following directions, writing stories and essays, pronouncing words, discriminating among sounds, learning the alphabet, and identifying letters. Gierut (1998) reported that there is an observed relationship between early phonological disorders and subsequent reading. In addition, Gierut's (1998) analysis of retrospective studies indicated that adults who had a phonological disorder in childhood continued to have overall difficulty with retrieval, manipulation, and comprehension of linguistic information. Catts et al. (1999) reported that children with language impairments are four to five times more likely than their typically developing peers to have reading difficulties during the school years. This statistic is supported by their finding that 73% of poor readers in their study had deficits in spoken language. In summary, the research supports the notion that a comprehensive tool which can provide information regarding interactions between spoken language, written language, and speech production should allow more efficient early identification of these developmental communication disorders.

A key aspect in effective utilization of a comprehensive tool is to target professionals who have the breadth and depth of knowledge about the constructs being measured. Speech-language pathologists are uniquely educated in providing assessment, intervention, consultation, and counseling services for individuals with speech and language disorders. Because many children with articulation and/or language disorders also present with reading disabilities it is incumbent upon our profession of Speech and Language Pathology to be involved in providing services for individuals with disorders that manifest in both spoken and written language. Many of the tasks employed during articulation or language therapy, such as training in joint book reading, narrative retelling, and sound blending and segmentation, are also skills necessary for efficient reading (ASHA, 2001). Additionally, master's level trained speech-language pathologists possess the academic background to make differential diagnoses for articulation disorders, language disorders, language differences, and reading disorders, as well as to identify a mixed disorder consisting of any combination of the three. Because children with spoken language impairments frequently have difficulty reading and writing, and children with written language impairments frequently have difficulty with spoken language, it is important to work with professionals who can provide empirically-based instructional procedures for preventing, remediating, and evaluating spoken language, written language, and speech production disorders (ASHA, 2001).

As stated previously, to date, no single assessment tool exists which analyzes spoken language, written language, and speech production. A tool of this nature could provide a more precise mechanism for making differential diagnoses of disorders such as specific language impairment, developmental dyslexia, and phonological disorder. Justice, Invernizzi, and Meier (2002) suggested that prevention of literacy problems could best be handled by designing and implementing an early literacy screening. The purpose of such a screening would be to identify children at-risk for later literacy problems, to indicate if a more comprehensive assessment of literacy should occur, and to provide baseline data for structuring literacy interventions. Later literacy achievement can be determined using measures of phonological awareness, alphabet knowledge, letter-sound knowledge, and other components of early literacy (Catts, Fey, Zhang, & Tomblin, 1999). Spoken language skills such as expressive and receptive vocabulary, morphological understanding and usage, narrative comprehension, story retelling, and story generation are also important for predicting literacy potential (Badian, 1998; Stothard et al., 2002). Justice, Invernizzi, and Meier (2002) suggested that tasks of written language awareness, phonological awareness, letter name knowledge, grapheme-phoneme correspondence, literacy motivation, and home literacy should be included in the screening of early literacy. Written language awareness encompasses recognizing the communicative function of written language, understanding the relationship between print and speech, knowing print-specific functions such as left-to-right directionality, knowing that words consist of letters, and recognizing environmental print. Components of phonological awareness range from basic skills such as comprehension and production of rhyme and alliteration to more complex skills such as phoneme manipulation. Letter name knowledge refers to a child's ability to identify each of the letters in the alphabet. The automaticity with which a child names letters is an important component in early literacy (Justice, Invernizzi, and Meier, 2002). Grapheme-phoneme correspondence refers to knowledge of the sound-symbol relationships between specific phonemes and graphemes. This skill, like letter name knowledge, is important for the application of alphabetic principles (Adams, 1990; Orton, 1994). Literacy motivation refers to the child's interest in interacting with literature. A child's enjoyment regarding literacy and reading can be greatly influenced by parents' attitudes, values, and expectations with respect to literacy (Snow, Burns, Griffin, 1998b; Snow, Burns, Griffin, 1998c). The availability of children's literature in the home, parent's reading to children, parents conversing with children about books read, and parent's frequency of reading books are all factors to consider in home literacy. Though Justice, Invernizzi, and Meier (2002) did not suggest a specific section for assessing speech production, they noted that children with a speech impairment, whether organic or functional, appear to be at-risk for literacy problems (Bishop & Adams, 1990; Boudreau & Hedberg, 1999). In summary, Justice, Invernizzi, and Meier's (2002) article along with ASHA's (2001) position statement provide a strong endorsement for the development of a comprehensive spoken and written language tool for speech-language pathologists.

Statement of the Problem

To date, no comprehensive single tool exists to assess written language, spoken language, and speech production in children during the initial school years. Over the past two years, a clinical tool that assesses written language, spoken language, and speech production at these young ages was developed by a team of three clinical researchers.

This tool, the Language, Learning, and Literacy Diagnostic Assessment (L3), was designed to reflect developmental changes in spoken and written language from preschool through first grade. The clinical rationale for the development of the L3 was threefold: 1) to assess spoken and written language behaviors found to predict later linguistic competencies, 2) to identify children who are already manifesting clinically-significant delays in written language, spoken language, and speech production skills, and 3) to provide a base for developing intervention goals for children who are delayed in one or more of the three global areas targeted. Data show unequivocably that early identification of children at-risk followed by immediate intervention is one of the best ways to combat later academic failure. (Ball & Blachman, 1991; Brown & Felton, 1990; Felton, 1993).

This study represents one step in examining the validity of the L3 by assessing the efficacy of this tool in differentiating developmental skills for spoken language, written language, and speech production in preschool, kindergarten, and first grade children This study addresses the following experimental questions:

Question 1: Does the *total composite L3* score discriminate between children at three grade levels?

Hypothesis 1: The total composite L3 scores for the first grade group and the preschool group, the preschool group and the kindergarten group, and the first grade group and the kindergarten group will differ significantly. Developmental differences in spoken language (Owens, 1996), written language (Treiman & Zukowski, 1991), and speech production skills (Bleile, 1995) of 4-, 5-, and 6-year old children suggest that L3 total composite scores should differ for preschool, kindergarten and first grade children.

Question 2a: Does the *spoken language composite score* differentiate between the three grade levels?

Question 2b: Which subtests in the L3 spoken language composite show differences in performance between the three grade levels?

Hypothesis 2: The spoken language scores for the first grade group and the preschool group, the preschool group and the kindergarten group, and the first grade group and the kindergarten group will be significantly different. Four-year-old children have a 1500-1600-word vocabulary and they begin to use more complex sentence forms, this age group has difficulty answering 'how' and 'why' questions and they also tend to rely on word order for interpretation of spoken language (Owens, 1996). Six-year-olds, however, have an expressive vocabulary of 2600 words and a receptive vocabulary of 20,000-24,000 words and are capable of producing well-formed complex sentences, using all parts of speech to some degree (Owens, 1996).

Question 3a: Does the *written language composite score* differentiate between the three grade levels?

Questions 3b: Which subtests in the L3 written language composite show differences in performance between the three grade levels?

Hypothesis 3: The written language skills of the first grade group and the preschool group, the preschool group and the kindergarten group, and the first grade group and the kindergarten group will be clearly differentiated. Phonological awareness is the key skill at this age that predicts later reading development. Treiman and Zukowski (1991) reported that preschoolers have difficulty analyzing smaller units within words (e.g., onset-rime tasks), whereas children in the first grade are able to recognize that single consonants in words match (e.g., crib and club).

Question 4a: Does the *speech production composite score* differentiate between three grade levels?

Question 4b: Which subtests in theL3 speech production composite show differences in performance between the three grade levels?

Hypothesis 4: A clear distinction will be noted between the preschool and first grade groups whereas no significant difference will occur between the preschool and kindergarten or kindergarten and first grade groups. Between two and five years of age, speech production becomes relatively established with some difficulty pronouncing entire sound classes still present (Bleile, 1995). Children who are five-years-old and older, however, tend to produce speech that is similar to that of persons in their community with any speech sound errors occurring on later-acquired sounds in more complex and/or multisyllabic words (Bleile, 1995).

CHAPTER 2
METHODOLOGY

The purpose of this study was to determine the efficacy of the Language, Learning, and Literacy Diagnostic Assessment (L3) in differentiating the spoken and written language skills in three groups of young children. Specifically, this study was completed to determine if the L3 is sensitive to developmental changes across a range of spoken and written language tasks for children at three grades: preschool, kindergarten and first grade. A variety of tasks was used to conduct measurements in each skill area. This chapter includes information on the participants, stimuli, examiners, equipment, procedures, scoring, and analysis.

Participants

The participants in this study were 34 children: 10 preschool children, 11 kindergarten children, and 13 first grade children. The preschool children were between four and five years old; the kindergarten children were between five and six years old; and, the first grade children were between six and seven years old. The children were chosen from preschool programs in Alachua County, Florida and the University of Florida's developmental research school. The children were not chosen randomly. Only children who had signed guardian consent forms for participation in the study as specified by the Human Subjects' IRB Committee at the University of Florida, qualified as participants. This form can be found in Appendix A.

Children who were suspected of having or were documented as having behavioral or neurological disorders that would interfere with valid testing were excluded from participating in the study. Also, children who were judged by their teachers to lack proficiency in spoken language because they are not native speakers of English were excluded.

Catts, Fey, Zhang, and Tomblin (2001) found that mother's education is one of five unique kindergarten variables that predict reading outcomes in second. Demographic variables for all participants and their mothers are shown in table 2.1 below

Table 2.1 Child and Parent Demographic Variables

Participant	Grade	Age	Gender	Mother's highest level of education	Income range of household
1	preschool	5.5	male	Master's/Specialist degree	\$21000-30000
2	preschool	5.33	male	2-4 years of college	\$10000-20000
3	preschool	5.75	female	12th grade	>\$51000
4	preschool	5.5	female	0-2 years of college	\$10000-20000
5	preschool	5	male	Master's degree	>\$51000
6	preschool	5.08	male	0-2 years of college	Not reported
7	preschool	5.5	female	0-2 years of college	\$31000-50000
8	preschool	4.92	male	Pursuing a Professional Degree	\$10000-20000
9	preschool	5	female	12th Grade	\$31000-50000
10	preschool	5.67	female	J.D./Ph.D.	>\$51000
11	kindergarten	5.83	female	Bachelor's degree	\$21000-30000
12	kindergarten	5.67	male	0-2 years of college	\$21000-30000
13	kindergarten	5.83	female	Graduate degree	\$31000-50000
14	kindergarten	6.25	male	Doctorate degree	>\$51000
15	kindergarten	6.25	male	Graduate degree	>\$51000
16	kindergarten	6.42	male	2-4 years of college	>\$51000
17	kindergarten	6.42	male	Bachelor's degree	\$31000-50000
18	kindergarten	5.92	male	Bachelor's degree	\$31000-50000
19	kindergarten	6.5	female	Professional degree	>\$51000
20	kindergarten	5.58	male	Graduate degree	>\$51000
21	kindergarten	5.92	male	Bachelor's degree	>\$51000
22	first	7.42	male	0-2 years of college	\$10000-20000
23	first	7.5	female	2-4 years of college	\$21000-30000
24	first	7.08	female	0-2 years of college	>\$51000

Table 2.1 Continued

Participant	Grade	Age	Gender	Mother's highest level of education	Income range of household
25	first	7.5	female	12th grade	>$51000
26	first	7.17	male	12th grade	$31000-50000
27	first	7.83	female	Bachelor's degree	>$51000
28	first	7.08	female	Bachelor's degree	$31000-50000
29	first	6.83	male	12th grade	$31000-50000
30	first	7.25	female	0-2 years of college	$31000-50000
31	first	6.92	male	M.D.	>$51000
32	first	7.33	female	2-4 years of college	$31000-50000
33	first	7.17	male	2-4 years of college	>$51000
34	first	6.83	female	Master's degree	>$51000

Examiners and Setting

The investigator and four research assistants were trained by the investigator to administer the entire L3 battery. Training occurred over several sessions which were approximately an hour-and-a-half in duration. The investigator discussed each subtest with the research assistants. The research assistants practiced administering the subtests at home and then they administered the subtests to each other during the second session. During the training sessions and throughout data collection, the investigator answered any questions pertaining to administration of the protocol and occasionally revised student instructions or coding procedures for greater clarity or accuracy. The research assistants were undergraduate or graduate students in the Department of Communication Sciences and Disorders at the University of Florida.

Data collection took place at each of the children' schools in a noise-free environment. Each child was tested individually. Most children were seen an average of three times for about 30 minutes to complete the test. The total test time averaged an hour and a half. The children were tested at the end of the school year from May 2002 through July 2002. No children dropped out of the study; however, one child was terminated from the study due to refusal to participate for the entire testing.

Instrumentation

The L3 was developed to assess multiple dimensions of spoken language, written language and speech production in children between 4 and 7 years of age. The entire test battery is shown in table 2-2 and table 2-3 below. The test response form, which shows all test instructions and stimuli can be found in Appendix A (only for committee members – note to be included in dissertation submission)

Table 2.2 Components of Written Language on the L3

Written Language	All grades	PK & K	K & 1st	1st
Print Concepts				
Letter Discrimination			•	
Visual Matching	•			
Identifying Beginning and Ending of Sentences	•			
Letter Recognition	•			
Letter Naming	•			
Name Writing		•		
Letter Production	•			
Concept of Word	•			
Phonological Awareness Concepts				
Rhyme Recognition in Words		•		
Rhyme Recognition in Sentences		•		
Rhyme Production in Words	•			
Rhyme Production in Sentences	•			
Rhyme Odd Man Out: Auditory-only	•			
Rhyme Odd Man Out: Auditory-Visual	•			
Rhyme in Story with Nonsense Words		•		
Alliteration Odd Man Out: Auditory-only	•			
Alliteration Odd Man Out: Auditory-Visual	•			
Phonemic Awareness Concepts				

Table 2.2 Continued

Written Language	All grades	PK & K	K & 1st	1st
Elision	•			
Phonics Principles	•			
Invented Spelling			•	
Sight Word Recognition			•	
Nonsense Word Recognition			•	
Spelling Recognition				•
Graphic Concepts				
Copying Geometric Forms		•		
Copying Letters		•		
Copying Words				•
Copying Sentences				•

Note: PK stands for preschool, K stands for kindergarten, and 1st stands for first grade

Table 2.2b Components of Spoken Language and Speech Production on the L3

Spoken Language	All grades	PK & K	K & 1st	1st
Receptive Language				
Receptive Vocabulary	•			
Lexical Order	•			
Morphological Familiarity	•			
Receptive: Spatial/Temporal Concepts	•			
Listening Comprehension	•			
Expressive Language				
Parallel Sentence Production	•			
Definitions			•	
Synonyms				•
Verbal Analogies	•			
Expressive: Spatial/Temporal Concepts	•			
Storytelling	•			
Naming				
Rapid Object Naming	•			
Rapid Color Naming	•			
Word Retrieval	•			

Speech Production				
Sounds in Words	●			
Complex Speech Production	●			
Pseudoword Repetition	●			

Note: PK stands for preschool, K stands for kindergarten, and 1st stands for first grade

Case History Questionnaire

A case history questionnaire was developed to accumulate developmental information in three areas: 1) family demographic information; 2) child's developmental history; and 3) family's reading activities. These questions were asked because of wealth of literature has shown that factors such as mother's level of education, socioeconomic status, and family history are predictive factors in children's success in learning to read. Other than some basic demographic data, parent's responses to these questions were not analyzed in this study and will be used for future analyses.

A parent or guardian of each child was required to complete a questionnaire that provided the researcher with information on demographic, developmental, and reading related activities relative to the home environment. Section 1 of the questionnaire addresses subjects' characteristics relevant to this study and is shown in table 2.3 below. The remaining two sections of the questionnaire are shown in this document.

Table 2.3. Family Background Section of the L3 Questionnaire

Section 1: Family Background

Date:_______________

Child's Name____

Child's Date of Birth__________________Age___________Grade____________

Parent(s)' Name(s)____

Mother's Age____________________ Father's Age_________________

Mother's Highest Level of Education Completed (Please circle one):

Elementary School (Grades K-5)

Middle School (Grades 6-8)

High School (Grades 9-12)

College*:* 0-2 years 2-4 years Bachelor's degree Master’s degree Doctorate Degree

List Professional Degree(s) if applicable

Father's Highest Level of Education Completed (Please Circle One):

Elementary School (Grades K-5)

Middle School (Grades 6-8)

High School (Grades 9-12)

College*:* 0-2 years 2-4 years Bachelor's degree Master's degree Doctorate degree

List Professional Degree(s) if applicable

Mother's Occupation________________________ Father’s Occupation______________

Household Income (Please circle one):

10,000-20,000 *21,000-30,000* *31,000-50,000* *greater than 51,000*

Do any of your children receive free or reduced lunch? (Please circle one) yes no

Do you or any other family members have a history of difficulty with:

Hearing *yes* *no*

If yes, who has this difficulty_________________________________

Speaking clearly as a child *yes* *no*

If yes, who has/had this difficulty______________________________.

Putting sentences together as a child *yes* *no*

If yes, who has/had this difficulty?______________________________

Learning the alphabet *yes* *no*

If yes who has/had this difficulty?______________________________

Learning to read *yes* *no*

If yes, who has/had this difficulty?______________________________

Learning to spell *yes* *no*

If yes, who has/had this difficulty?______________________________

Writing letter or writing sentences. *yes* *no*

If yes, who has/had this difficulty?______________________________

School work in general? *yes* *no*

If yes, who had this difficulty?______________________________

Has or does your child experience(d) any of the following :

	Yes	No		Yes	No
Frequent laryngitis			Reading/spelling problems		
Epilepsy/seizures			Other academic problems		
Attention Deficit Disorder			Neurological Disorders		

L3 Protocol Description

In the sections below, the L3 Assessment Battery is described in detail. Each of the subtests are described under one of the three major sections of the instrument: written language, spoken language, and speech production. Scoring matrices for seven subtests, Verbal Analogies, Invented Spelling, Definitions, Synonyms, Listening Comprehension, Word Retrieval, and Storytelling, that required more subjective scoring procedures can be found in Appendix B.

Section 1: Written Language Domain

The purpose of the pre-literacy and early literacy domain is to assess skills that have been shown to be good predictors of later reading ability (Adams, 1990; Goswami & Bryant, 1990; Torgesen, Wagner & Rashotte, 1998). This composite of skills consists of print concepts, phonological awareness concepts, phonemic awareness concepts, and graphic concepts.

Print concepts

The Letter Discrimination subtest measures the child's ability to discriminate between figures which are letters and those which are not letters. A sample item is included to insure that the child is capable of performing the task. The examiner asks, "Is this a letter?" The child states “yes” or “no” to indicate whether a specific figure is a letter. The child is required to judge 24 randomly ordered figures. All 24 figures are presented to the child using large typeface. A total of 24-points is possible on this subtest. This task was developed for kindergarten and preschool children.

The Visual Matching subtest measures the child's ability to detect two identical letters or numbers, or strings of letters or numbers. Three samples are included which consist of letters or numbers to insure that the child understands the task. The examiner asks the child, "Which two are the same?" The child then indicates the correct responses by pointing to the matching letters or numbers, or strings of letters or numbers. There were a total of 12 test stimuli. Each row consists of the two targets and four foils. All of the stimuli are presented on one side of an 8.5 by 11 inch card using large typeface. A total score of 12-points is possible on this subtest. This task was developed for children at all three grade levels.

The Identifying Beginning and Ending of Sentence subtest measures the child's ability to determine the beginning and ending of a sentence. The child is shown two sentences with one sentence displayed on one side of an 8.5 by 11 inch card and the second sentence displayed on the other side of the card. The font is enlarged. The child is asked to identify the beginning and end of each of the following sentences by pointing to the first and last word in two sentences: (1)*The boy is sleeping on his bed.* and (2) *The dog is running down the street.* A total of four points is possible on this task. This task was designed for children at all three grade levels.

The Alphabet Knowledge subtest consists of four tasks: letter-recognition, letter-naming, name writing, and letter production. The child's ability to point to each letter requested by the examiner is measured on the *letter-recognition* subtest. Two sample items are given to the child to insure that s/he understands the task. The child is shown an 8.5 by 11 inch card containing 12 uppercase letters and the same 12 letters in lowercase with all letters presented on the same side of the card. The typeface is large. While pointing to the letter, the examiner says, "Point to ________." This task was designed for children at all three grade levels. A total of 24-points is possible on this task.

The child's ability to name uppercase and lowercase letters is measured on the *letter-naming* subtest. Two sample items are given to the child to insure that the child understands the task. The child is shown an 8.5 by 11 inch card containing 12 uppercase letters and the same 12 letters in lowercase with all letters presented on the same side of the card. The typeface is large. While pointing to the letter, the examiner says, "Tell me what letter this is?" A total of 24-points is possible on this task. This task was developed for children at all three grade levels.

The *name writing* subtest requires the child to write his or her name on a sheet of plain paper and then identify each letter in the opposite direction they were written. The child receives one point if s/he can identify all letters produced. This was designed for preschool and kindergarten children.

The *letter production* subtest measures the child's ability to write 12 letters dictated by the examiner. The examiner says to the child, "I'm going to ask you to write some letters. When I say the letter, you write it right here (space on record form)." Uppercase or lowercase letters are acceptable. A total of 12-points is possible on this task. This task was developed for children at all three grade levels.

The Concept of Word subtest measures the child's familiarity with books and it was adapted from Morris' (1992) *Early Reading Screening Instrument.* Each page displays a picture associated with the sentence on that page. Prior to reading the story, the examiner asks the child to talk about each page so that the child is familiarized with the book. While looking at the first page, the examiner asks the child, “What is she doing?”, on the second page the examiner asks the child, “Oh, now what do you see?”, and on the final page the examiner asks the child, “Now what do you see?” The examiner then reads the story while pointing to each word in the sentence on each page. Then, the examiner and child read together while pointing to each word on each page. Finally, the child reads the sentence on each page while pointing to each word in the sentence. One point is given for each page in which the child points to every word in the sentence. A total of three points is possible on this task. Also, after the child reads a sentence, the examiner asks him or her to point to a specific word in the sentence. A total of three points is possible on this task of word identification. A combined score of six points is possible on this task. This task was developed for children at all three grade levels.

Phonological Awareness Concepts

The Rhyme Recognition in Sentences subtest measures the child's ability to indicate whether two words rhyme in a simple sentence spoken by the examiner. Three sample items are given to insure that the child understands the task. The examiner says, "Now, I am going to say some sentences, and I want you to tell me if you hear two words that rhyme in the sentence." The examiner presents ten sentences with five of the sentences containing two rhyming words. The child is instructed to say “yes”, if two rhyming words are included in the sentence or to say “no” if two rhyming words are not included in the sentence. A total 10-points is possible on this task with each sentence being worth one point. This was designed for children in preschool and kindergarten.

The Rhyme Recognition in Words subtest measures the child's ability to indicate if two spoken words rhyme. Three sample items are given to insure that the child understands the task. The examiner says, "I’m going to say some words, and I want you to tell me if the words rhyme." The examiner presents ten pairs of words with five pairs composed of rhyming words. The child is instructed to say “yes” if the two words rhyme or say “no” if the two words do not rhyme. A total of 10-points is possible on this task with each item being worth one point. This task was developed for children in preschool and kindergarten.

The Rhyme Production in Words subtest measures the child's ability to generate a rhyming word that contains the same rime as three words spoken by the examiner. Three sample items are provided to insure that the child understands the task. The examiner says, "I am going to say three words that rhyme and I want you to tell me another word that rhymes with them. It can be a real word or a made-up word (e.g., mitt-hit-lit)." After the child provides a response, the examiner says, "Now can you give me one more word that rhymes with … (e.g., mitt-hit-lit)?" The examiner presents five different word groupings containing three words. A total 10-points is possible on this task with each item being worth two points. This task was designed for children at all three grade levels.

The Rhyme Production in Sentences subtest measures the child's ability to generate a rhyming word that contains the same rime as a specific word in a phrase stated by the examiner. Three sample items are provided to insure that the child understands the task. The examiner says, "Now, I'm going to say a sentence and leave off the last word. I want you to fill in the last word with a word that rhymes. The word must be a real word (e.g., The bug chased the _____)". The examiner states the phrase and target word for which a rhyme is needed. Then, the examiner repeats the phrase to the child. The child then generates a word containing the same rime as the target word the examiner states. After the child generates a word, the examiner says, "Now can you give me one more word that rhymes with… (e.g., bug)?" A total of 10-points is possible for this task with each item being worth two points. This task was developed for children at all three grade levels.

The Rhyme Odd Man Out: Auditory-only subtest measures the child's ability to identify the spoken word that does not rhyme with other spoken words in its group.

Three sample items are given to insure that the child understands the task. The examiner says, "Listen to these words and tell me which one does not sound the same as the others. Which one does not rhyme?" For each of the ten test items, the examiner presents three to four words and the child gives the word that does not rhyme with the other three or four words. A total of 10-points is possible for this task with each item being worth one point. This task was designed for children at all three grade levels.

The Rhyme Odd Man Out: Auditory-Visual subtest requires the child to identify the picture with a name that does not rhyme with the names of the other pictures in the group. Three sample items are given to insure that the child understands the task. The examiner says, "Look at these pictures as I name them, and tell me which one does not sound the same as the others. Which one does not rhyme?" For each of the ten test items, the examiner directs the child to look at a row of three to four pictures on the page as the names of the pictures are stated by the examiner. The child states the word and/or points to the picture that does not rhyme with the other three or four pictures. The child is shown 8.5 by 11 inch cards containing the pictures for all ten stimuli. The names of the pictures are not written on the card. A total of 10-points is possible for this task with each item worth one point. This task was designed for children at all three grade levels.

The Rhyme in Story with Nonsense Words subtest measures the child's ability to generate a rhyming word, either a real word or nonsense word, that contains the same rime as a target word within each test sentence read to the child. The examiner says, "I'm going to tell you a silly story about Jane. This story has pretend words. Even though they are silly words, many of them rhyme. At the very end of the story, I want to see if you can help me finish it by giving me some silly words that rhyme." The examiner reads the story emphasizing the two rhyming words in each sentence. The examiner points to the child when it is his or her turn to generate a word that rhymes with the target word in the sentence. A total of five points is possible for this task with each accurate response being worth one point. This task was developed for children at all three grade levels.

The Alliteration Odd Man Out: Auditory-only subtest measures the child's ability to identify the spoken word that does not begin with the same sound as the other words in the group of words spoken by the examiner. Three sample items are given to insure that the child understands the task. The examiner says, "I want you to tell me which word does not start with the same sound as the others." For each of the ten test items, the examiner presents three to four words and the child responds with a word that does not begin with the same sound as the other three or four words in the group. A total of 10-points is possible for this task with each accurate response being worth one point. This task was developed for children at all three grade levels.

The Alliteration Odd Man Out: Auditory-Visual subtest requires the child to identify the picture with a name that does not begin with the same sound as the other pictures in the group. Three sample items are given to insure that the child understands the task. The examiner says, "I want you to look at these pictures while I name them. Tell me which one does not start with the same sound as the others." For each of the ten test items, the examiner directs the child to look at a row of three to four pictures on the page as the names of the pictures are stated by the examiner. The child states the word and/or points to the picture that does not begin with the same sound as the other three or four pictures. The child is shown 8.5 by 11 inch cards containing the pictures for all ten stimuli. The names of the pictures are not written on the card. A total of 10-points is possible for this task with each item being worth one point. This task was designed for children at all three grade levels.

Phonemic awareness

The Elision subtest measures the child's ability to repeat a word and then produce a part of that word after leaving out a specific phoneme or syllable. Three sample items are given to insure that the child understands the concept of the task. The examiner says, "I'm going to say a word and I want you to repeat the word. Then, I want you to say the word again and then I'll tell you to leave off a part of the word." For each of the ten test items, the examiner asks the child to repeat the target word and then repeat that same word leaving out a syllable or sound. The child repeats the word and then produces the new word with the sound or syllable deleted. A total of 10-points is possible for this task with each item being worth one point. This task was designed for children at all three grade levels.

The Phonics Principles subtest measures the child's ability to name the phoneme (i.e., letter sound) that corresponds with a specific grapheme (i.e., letter). Two sample items are given to insure that the child understands the concept of the task. The examiner says, "I want you to look at some letters and tell me what sound each letter makes." The child is shown an 8.5 by 11 inch card containing 12 uppercase letters and the same 12 letters in lowercase with all letters presented on the same side of the card. The child produces the sound for each letter (e.g., m, b, s, t, a , etc.). A total score of 24-points is possible for this task with each item being worth one point. This task was administered to children at all three grade levels. In addition, 15 more complex letter combinations (e.g., ee, ai, th, str, etc.) are printed on another card. Using the same procedure as described above, the child is asked to produce the sound associated with the letter combinations. A total of 15-points is possible for this task. The first part of the task is appropriate for children at all three grade levels. The second part of the task was developed for children in first grade.

The Invented Spelling subtest measures the child's ability to spell words using phonemic knowledge. The examiner says, "I want you to write the words I say." The child writes the 10 words on a sheet of paper containing only numbers and lines. A word receives no points if the initial sound in a word is not represented first (e.g., *ab* for *ball*). One point is given if the first letter of the word is represented first (e.g., *b* for *ball*). Three points are given if three correct letters are written in the correct order (e.g., *drm* for *drum*). Four points are given if a) at least three correct letters including a vowel are written in order (e.g., *drumb* for *drum*), b) there is an attempt to make the vowel in the word long by adding a phonetically appropriate sound (e.g, *haide* for *hide*), or c) if the attempt is phonetically appropriate versu. providing a conventional spelling of the word (e.g., *boll* for *ball)*. Five points are given if the conventional spelling is given (e.g., *ball* for *ball*). A total of 50-points can be obtained from this task. This task is appropriate for children in kindergarten and first grade.

The Word/Nonsense Word Reading subtest is composed of sight word recognition and the nonsense word decoding. The *sight word recognition* subtest measures the child's ability to read a list of 14 common and age-appropriate words. The examiner says, "I am going to show you some words and I want you to read them for me. If you don't know the word, give me your best guess." The child receives one point for each word read accurately. A total of 14-points is possible on this task. This task is appropriate for children in kindergarten and first grade.

The *nonsense word decoding* subtest measures the child's ability to read decodable words. The same procedure described for real word reading is used and the child receives one point for each word read correctly. A total of 14-points is possible on this task. This task is appropriate for children in kindergarten and first grade.

The Spelling Recognition subtest measures the child's ability to circle a nonsense word produced by the examiner. One sample item is given to insure that the child understands the task. The examiner says, "I am going to say a pretend word, and I want you to circle the pretend word that I am saying. Remember, these are not real words. Circle the word that you heard me say." The child receives one point for each correct answer with a total of 10 possible points. This task was developed for children in the first grade.

Graphic concepts

The purpose of this section is to assess hand-eye coordination in copying nonlinguistic and linguistic stimuli. The section consists of copying geometric forms, letters, words in isolation, and sentences. The Design Reproduction shapes and scoring procedures from the Detroit Test of Learning Aptitude-3 (1991) were adapted for this subtest.

The Copying Geometric Forms subtest measures the child's ability to copy shapes such as a circle, square, diamond, and a diamond containing a square. The examiner says, “I want you to copy each shape on the line beneath it.” The child receives one point if an approximation of shape is drawn (e.g., lines may be uneven, wavy, imprecise) with an accurate number of sides or points. If the child's representation is not clearly recognizable as the target shape, then child receives no points. A total of four points is possible for this task. This task was developed for children preschool and kindergarten. The Copying Letters subtest measures the child's ability to copy four uppercase letters: E, V, M, Z. The examiner says, "I want you to copy each letter on the line beneath it." The child receives one point if an approximate letter shape is drawn (e.g., lines may be uneven, wavy, imprecise; letter may be backwards). A total of four points is possible. This task was developed for children in preschool and kindergarten.

The Copying Words subtest measures the child's ability to copy four words: cat, dogs, baseball, treehouse. The examiner says "I want you to copy each word on the line beneath it." The child receives two points if an approximate letter shape and the correct number of letters is represented, or if a no more than two letters are backwards in a word. One point is given if the letters in a word are not spaced accurately. No points are given if the child does not have the correct letter shape, number of letters, or if the representation is not recognizable as the target word. A total of 16-points is possible. This subtest was designed for children in the first grade.

The Copying Sentences subtest measures the child's ability to copy four sentences verbatim: I like toys; I eat cake; The boy runs; and A dog barks. The examiner said, "I want you to copy each sentence on the line beneath it." The child receives two points if s/he produces a complete and accurate representation of all words, the correct letter shapes, number of words, and spaces (3) in between each word. The child receives one point if s/he produces an approximate letter shape but the correct number of words; uneven, wavy, or imprecise letters; incorrect spacing between words; or up to four letters backwards across all words. The child receives no points if s/he does not have all correct letters in the words or if the sentence is not recognizable as the target. A total of 16-points is possible. This task was designed for children in the first grade.

Section II: Spoken Language Domain

The purpose of the spoken language section is to assess a range of semantic and syntactic skills across tasks and varying levels of linguistic complexity. The spoken language tasks assess both receptive and expressive language skills.

Receptive language

The Receptive Vocabulary subtest measures the child's ability to identify nouns and verbs displayed in a picture format. The examiner says, "I am going to say a word and I want you to point to the picture that goes with the word." For each of the test items, the child points to one of the eight pictures shown on an 8.5 by 11 inch card. A total of 24-points is possible for this task with each item being worth one point. This task is appropriate for children at all three grade levels.

The Lexical Order subtest measures the child's ability to comprehend simple and complex sentences. One sample item is given to insure that the child understands the task. The examiner says, "I am going to show you a picture and read two sentences. I want you to point to the picture that goes with my sentence." For each of the six test items, three pictures are displayed and the child points to the picture that corresponds with the sentence spoken by the examiner. The child is shown 8.5 by 11 inch cards containing the pictures for the ten test items. A total of 10-points is possible for this task with each item being worth one point. This task was designed for children at all three grade levels.

The Morphological Familiarity subtest measures the child's ability to judge the syntactic accuracy of a sentence. Three sample items are given to insure the child understands the task. The examiner says, "This is Bob, and this is Jane. They will each say a sentence. Then, I want you to point to the one that said the sentence correctly." Since repetition is not being tested; pointing to the correct speaker is acceptable for this task. A little boy representing Bob is on one half of an 8.5 by 11 inch card, while a picture representing Jane is on the other half. A total of 10-points is possible for this task with each item being worth one point. This task was developed for children at all three grade levels.

The Receptive: Spatial-Temporal Concepts subtest measures the child's ability to comprehend spatial and temporal relationships. Two sample items are given to insure that the child understands the task. The examiner says, "I want you to point to the picture that I am describing." For each of the six test items, the child points to one of three pictures displayed on an 8.5 by 11 inch card. A total of 10-points is possible for this task. This task was developed for children at all three grade levels.

The Listening Comprehension subtest measures the child's ability to comprehend a short story as measured by his or her ability to answer two factual and two inferential questions about that story. The examiner says, "I am going to read you a story, listen closely." The child receives one point for each response that provides adequate information to answer each question. The first two questions are factual and the last two questions are inferential. A total of four points is possible for this task. *Bobby's Balloon* is appropriate for children in preschool and kindergarten, and *Jenny's Junk* was designed for children in first grade

Expressive language

The Parallel Sentence Production subtest examines a child's ability to use a variety of morphological and syntactic structures when given a verbal and visual cue. Three sample items are given to insure that the child understands the task. The examiner says, "I am going to show you a picture and tell you something about it. Then, I am going to show you another picture and I want you to finish the sentence." For each of the test items, the child is required to use the correct morphological or syntactic structure. The child is shown a series of 8.5 by 11 inch cards containing pictures for the test items. A total of 30-points is possible for this task with each item being worth one point. This task was designed for children at all three grade levels.

The Definitions subtest examines the ability to define words (e.g., *lamp*, unhappy). One sample item is given to insure that the child understands the task. The examiner says, "I want you to tell me about the word I say." For each of the five test items, the child provides a description of a specific object or state-of-being using a phrase or sentence. A total of five points is possible on this task with each item being worth one point. This task was developed for children in kindergarten and first grade.

The Synonyms subtest examines the ability to provide a synonym for each word produced by the examiner. Three sample items are given to insure that the child understands the task. The examiner says, "I am going to say a word and I want you to tell me another word that means the same thing as the word I've said." For each of the ten test items, the child provides a synonym for the test item given by the examiner. A total of 10-points is possible for this task with each item being worth one point. This task was designed for children in first grade.

The Verbal Analogies subtest measures the child's ability to use knowledge of word associations to deduce the appropriate answer in a simple analogy. The examiner says, "I want you to give me a word that fits into the sentence." Two sample items are given to insure that the child understands the task. The examiner reads one analogy and then begins reading another analogy with a similar word association. The child finishes the second analogy by stating the target word. One point was given for each analogy completed correctly. Responses that 1) provided categorical labels similar in function to the target word, and 2) responses that were not always syntactically correct were accepted because of the developmental levels of the participants (see Appendix B). A total of 10-points is possible for this task. This task was developed for children at all three grade levels.

The Expressive: Spatial-Temporal Concepts subtest measures the child's ability to answer yes/no questions using knowledge of spatial and temporal relationships. Two sample items are given to insure that the child understands the task. The examiner says, "I want you to listen to what I say and answer the questions I ask you." For each of the ten test items, the child answers either yes or no. A total of 10-points is possible for this task with each item being worth one point This task was developed for children at all three grade levels.

The Storytelling subtest measures the ability to tell the story depicted by a series of picture cards using age-appropriate vocabulary and syntax. The examiner puts the story cards in the correct order and then says, "I want you to tell the story the cards tell." The child receives one point for the correct usage of two nouns (e.g., car, station wagon, dog, puppy, pet store, book, pencil), one point for the correct usage of two verbs (e.g, waving, coloring, drawing, writing, jumped out, riding, driving, sees, bought), one point for talking about each picture, and one point if all sentences produced are semantically and syntactically complete. Therefore, a total of 4-points is possible for this task. Children in preschool and kindergarten used the story cards associated with *Tina's Truck*, while the children in first grade used the story cards for *Sam's Surprise*.

The Rapid Naming subtest consists of rapid object naming and rapid color naming. Both naming tasks measure the child's ability to retrieve linguistic information from long-term memory. For the *rapid object naming* subtest, the examiner says, "I am going to show you some pictures. I want you to name the pictures you see as quickly as possible. On the next sheet, you will see the same objects and I want you to name them as quickly as possible." The child is shown five pictures at the top of a page to become familiar with the objects. The child is shown two 8.5 by 11 inch cards displaying the same 5 pictures (i.e, car, dog, house, book, tree) randomly placed so that there are 36 on each page with four rows and nine columns of pictures on each page. The time in seconds it takes the child to state the name of the objects on both of the sheets is summed together. This task was used for children at all three grade levels. For the *rapid color naming* subtest, the examiner says, "I am going to show you some colors. I want you to name the colors on this practice sheet. On the next sheet, you will see the same colors and I want you to name the colors as fast as you can. Do not stop until you get to the last color on the sheet." The child is shown five colors (i.e., red, black, yellow, blue, green) at the top of the page to become familiar with the colors. The child is shown two 8.5 by 11 inch cards displaying the same 5 colors randomly placed so that there are 36 on each page with four rows and nine columns of colors on each page. The time in seconds it takes the child to state the name of the colors on both of the sheets is summed together. This task was used for children at all three grade levels.

The Word Retrieval subtest measures the child's ability to recall and recite items from a specific category within 60 seconds. The examiner says, "I am going to say a word like animal and then I want you to name animals until I say stop. So you could say, dog, cat etc. Now, I want you to name as many foods as you can, as fast as you can, until I say stop." The criteria for scoring, as well as acceptable answers are included in Appendix D. The total score is the number of food items stated minus any repeated items or any other redundant items (e.g., the word “fruit” is not accepted when specific fruits are also mentioned). This task was used for children at all three grade levels.

Section III: Speech Production Domain

The purpose of the speech production task is to assess the ability to produce speech sounds. This section consists of subtests that examine speech sound production in words and complex phrases, as well as nonsense word repetition. If a child’s speech error(s) on the Complex Speech Production subtest and the Pseudoword Repetition subtest were consistent with those on the Sounds in Words subtest, then they were not counted as incorrect.

The Sounds in Words subtest measures the child's ability to produce speech sounds in initial and final position in words. The examiner says, "I'm going to show you some pictures. I want you to name the picture that I point to." Any sound substitutions, omissions, additions, or distortions of target sounds are documented on the test form by writing the error response in the test booklet on top of the target sound. A total of 21 sounds in the initial position of words and 13 sounds in the final position of words are targeted. A total of 34-points is possible for this task. This task was designed for children at all three grade levels.

The Complex Speech Production subtest measures the child's ability to repeat verbatim a complex phrase. The examiner says, "I'm going to say a few words. I want you to repeat just what I say. Listen carefully because some of these are hard to say." The child receives one point for each word or phrase repeated correctly. A total of 10-points is possible on this task. This task was developed for children at all three grade levels.

The Pseudoword Repetition subtest measures the ability to hold novel linguistic information in working memory long enough to repeat it verbatim. The examiner says, "I'm going to say a few made-up words. I want you to repeat just what I say. Listen carefully because some of these are hard to say." The child receives one point for each word repeated verbatim. A total score of 10-points is possible on this task. This task was developed for children at all three grade levels.

Reliability Procedures

A 'reliability by consensus' procedure was used to evaluate the participant's responses on a subset of seven tests that required subjective judgments for determining scores. These subtests included: Verbal Analogies, Invented Spelling, Definitions, Synonyms, Listening Comprehension, Word Retrieval, and Storytelling. Only these subtests were chosen because participants' responses to questions on these tests were open-ended and therefore were subject to the subjective judgments of the raters. In an attempt to score these responses reliably, participants' responses to these seven tests were evaluated by two raters. This procedure was used for 32 of the 34 participants. Due to time constraints, the last two participants tested were evaluated solely by the primary researcher. While a secondary rater was available to discuss any ambiguous responses, assistance was not deemed necessary by the primary rater. The procedural steps used by the raters in establishing a consensus are as follows: 1) Two raters (in some cases three raters) independently coded the seven tests for 32 of the 34 participants; 2) Raters compared codes and discussed differences when they occurred; 3) Criteria for judging responses was modified if necessary and; 4) Two raters agreed on the final code. The scoring rubric for each of the aforementioned subtests is in Appendix A.

CHAPTER 3
RESULTS

The purpose of this study was to determine the efficacy of a Language, Learning, and Literacy Diagnostic Assessment (L3) in examining spoken and written language in three groups of young children. Specifically, this study was completed to determine if the L3 instrument is sensitive to developmental changes across a range of spoken language, written language and speech tasks for children at three grades: preschool, kindergarten and first grade.

Descriptive and comparative data for the subjects across the three grades are reported below. Means, standard deviations, and ranges were calculated for all groups on all tests administered. For all comparative measures across groups, Analyses of Variance (ANOVA) was performed at a .05 level of significance. Significant differences between the least square (estimated) means of groups were derived by running the Least Significant Difference test with a significance level of .05 ANOVA, which is one of most popular statistical analyses, is based on a linear relationship between response variable and explanatory variables. It shares the same principles and assumptions with the linear regression except that some of explanatory variables are categorical. The ANOVA focuses on analyzing variation in means of categories. We assumed the normality of the response variable in this study, which is most common setup of the ANOVA. For more details on these procedures, see Casella and Berger (2002) and Agresti (1996). Tables

3.48 and 3.49 contain data from the post hoc analyses, Least Significant Differences method, computed on all ANOVAs with statistical significance.

Only scores from subtests administered to all grade levels were included in the three composite scores for written language, spoken language and speech production. Rapid naming and word retrieval tests were administered to all three grades; however, because these tests yield data that is based on the number of items produced in a specified period of time (i.e., # of words in 60 seconds), the calculation of total scores were not possible.

Descriptive Analysis: L3 Composite

The mean L3 composite raw score for the preschool group was 224.3 (67.2%) out of a possible maximum score of 334 with a standard deviation of 54.6. The mean L3 composite raw score for the kindergarten group was 284.7 (85.2%) out of a possible maximum score of 334 with a standard deviation of 19.1. The mean L3 composite raw score for the first grade group was 305.5 (91.5%) out of a possible maximum score of 334 with a standard deviation of 14.6.

Table 3.1 Descriptive Statistics for L3 Total Composite

Group	Mean	Standard Deviation	Minimum	Maximum
Preschool	232.9	54.6	159	307
Kindergarten	295.5	19.1	248	320
First Grade	316.3	14.6	289	318

Boxplots were used to display these descriptive findings. The boxplot (or box and whisker plot) is a graphical presentation of summary statistics of data. The boxplot has a box and two whiskers. The box consists of three parts, the top, the horizontal line inside of the box and the bottom of box. Each represents the 75 percentile (3rd quartile), median and 25 percentile (1st quartile), respectively. So, the box represents 50 percent of data. Whiskers show how the remainder of the 50 percent of the data spread out on both sides of the box along with observations that are outliers. Since the purpose of the box plot is a robust data display, it uses the interquartile range instead of standard deviation for the purpose of outlier detection. The interquartile range is the length between the 3rd quartile and 1st quartile. The whisker in the upper part is the connections between the top of box and the maximum observation within the upper fence, which is 1.5 times the interquartile range above the top of box. The whisker in the lower part is drawn in a similar manner. The observations outside of two fences are marked with "*". Those observations are suspected as outliers.

As shown in figure 3.1 below there is no overlap for L3 composite scores for the top quartile of the preschool group and bottom quartile of the kindergarten group. Nor is there an overlap for L3 composite scores for the top quartile of the preschool group and the bottom quartile of the first grade group. A slight overlap is observed between the top quartile for the kindergarten group and the bottom quartile for the first grade group. A summary of all comparative findings are shown in table 3.50-3.51 below.

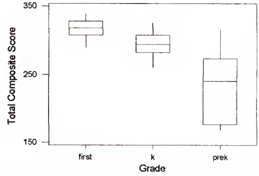


Figure 3.1 Box plots of Total Composite Score by Grade

Descriptive Analysis: Written Language Domain

The mean composite Written Language domain raw score for the preschool group was 106.7 out of a possible maximum score of 181 (59%) with a standard deviation of 41.4. The mean composite Written Language domain raw score for the kindergarten group was 153.5 out of a possible maximum score of 181 (85%) with a standard deviation of 14.9. The mean composite Written Language domain raw score for the first grade group was 165.2 out of a possible maximum score of 181 (91%) with a standard deviation of 7.3.

Table 3.2 Descriptive Statistics of Written Language Composite

Group	Mean	Standard Deviation	Minimum	Maximum
Preschool	106.7	41.4	55	172
Kindergarten	153.5	14.9	137	177
First Grade	165.2	7.3	152	177

As shown in figure 3.2 below there is no overlap of written language composite scores for the top quartile for the preschool group and bottom quartile for the kindergarten group. Additionally, there is no overlap of written language composite scores for the top quartile for the preschool group and the bottom quartile for the kindergarten group. Some overlap is observed between the top quartile for the kindergarten group and the bottom quartile for the first grade group.

Print Concepts

Letter discrimination

The mean Letter Discrimination raw score for the preschool group was 20.8 out of a possible maximum score of 24 (87%) with a standard deviation of 2.9. The mean Letter Discrimination raw score for the kindergarten group was 23.0 out of a possible maximum score of 24 (96%) with a standard deviation of 1.8.

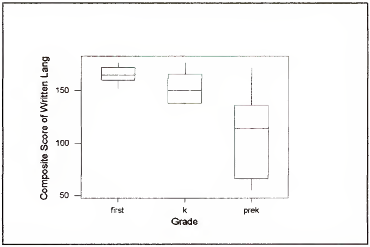


Figure 3.2 Box plots of Composite Score of Written Language by Grade

Table 3.3 Descriptive Statistics of Letter Discrimination

Group	Mean	Standard Deviation	Minimum	Maximum
Preschool	20.8	2.9	17	24
Kindergarten	23.0	1.8	18	24

Visual matching

The mean Visual Matching raw score for the preschool group was 8.4 out of a possible maximum score of 12 (70%) with a standard deviation of 1.8. The mean Visual Matching raw score for the kindergarten group was 9.8 out of a possible maximum score of 12 (82%) with a standard deviation of 1.7. The mean Visual Matching raw score for the first grade group was 11.6 out of a possible maximum score of 12 (97%) with a standard deviation of 0.9.

Table 3.4 Descriptive Statistics of Visual Matching

Group	Mean	Standard Deviation	Minimum	Maximum
Preschool	8.4	1.8	6	11
Kindergarten	9.8	1.7	7	12
First Grade	11.6	0.9	9	12

Identifying beginning and ending of sentence

The mean Identifying Beginning and Ending of Sentence raw score for the preschool group was 3.6 out of a possible maximum score of 4 (90%) with a standard deviation of 1.3. The mean Identifying Beginning and Ending of Sentence raw score for the kindergarten group was 4.0 out of a possible maximum score of 4 (100%) with a standard deviation of 0. 4 and 4 respectively. The mean Identifying Beginning and Ending of Sentence raw score for the first grade group was 4.0 out of a possible maximum score of 4 (100%) with a standard deviation of 0.

Table 3.5 Descriptive Statistics of Identifying Beginning and Ending of Sentence

Group	Mean	Standard Deviation	Minimum	Maximum
Preschool	3.6	1.3	0	4
Kindergarten	4.0	0.0	4	4
First Grade	4.0	0.0	4	4

Alphabet knowledge

Letter recognition. The mean Letter Recognition raw score for the preschool group was 18.9 out of a possible maximum score of 24 (79%) with a standard deviation of 4.3. The mean Letter Recognition raw score for the kindergarten group was 23.1 out of a possible maximum score of 24 (96%) with a standard deviation of 0.9. The mean Letter Recognition raw score for the first grade group was 24 out of a possible maximum score of 24 (100%) with a standard deviation of 0.

Table 3.6 Descriptive Statistics of Letter Recognition

Group	Mean	Standard Deviation	Minimum	Maximum
Preschool	18.9	4.3	11	24
Kindergarten	23.1	0.9	22	24
First Grade	24.0	0.0	24	24

Letter naming. The mean Letter Naming raw score for the preschool group was 17.7 out of a possible maximum score of 24 (74%) with a standard deviation of 6.1. The mean Letter Recognition raw score for the kindergarten group was 23.6 out of a possible maximum score of 24 (98%) with a standard deviation of 0.7. The mean Letter

Recognition raw score for the first grade group was 24 out of a possible maximum score of 24 (100%) with a standard deviation of 0.

Table 3.7 Descriptive Statistics of Letter Naming

Group	Mean	Standard Deviation	Minimum	Maximum
Preschool	17.7	6.1	8	24
Kindergarten	23.6	0.7	22	24
First Grade	24.0	0.0	24	24

Name writing. The mean Name Writing raw score for the preschool group was 0.9 out of a possible maximum score of 1 (90%) with a standard deviation of 0.3. The mean Name Writing raw score for the kindergarten group was 1 out of a possible maximum score of 1 (100%) with a standard deviation of 0.

Table 3.8 Descriptive Statistics of Name Writing

Group	Mean	Standard Deviation	Minimum	Maximum
Preschool	0.9	0.3	0	1
Kindergarten	1.0	0.0	1	1

Letter production. The mean Letter Production raw score for the preschool group was 8.0 out of a possible maximum score of 12 (67%) with a standard deviation of 4.8. The mean Letter Production raw score for the kindergarten group was 11.3 out of a possible maximum score of 12 (94%) with a standard deviation of 1.8. The mean Letter Production raw score for the first grade group was 11.9 out of a possible maximum score of 12 (99%) with a standard deviation of 0.3.

Table 3.9 Descriptive Statistics of Letter Production

Group	Mean	Standard Deviation	Minimum	Maximum
Preschool	8.0	4.8	0	12
Kindergarten	11.3	1.8	6	12
First Grade	11.9	0.3	11	12

Concept of word

The mean Concept of Word raw score for the preschool group was 2.3 out of a possible maximum score of 6 (38%) with a standard deviation of 1.7. The mean Concept of Word raw score for the kindergarten group was 5.5 out of a possible maximum score of 6 (92%) with a standard deviation of 0.8. The mean Concept of Word raw score for the first grade group was 5.9 out of a possible maximum score of 6 (99%) with a standard deviation of 0.3.

Table 3.10 Descriptive Statistics of Concept of Word

Group	Mean	Standard Deviation	Minimum	Maximum
Preschool	2.3	1.7	1	6
Kindergarten	5.5	0.8	4	6
First Grade	5.9	0.3	5	6

Phonological Awareness Concepts

Rhyme recognition in sentences

The mean Rhyme Recognition in Sentences raw score for the preschool group was 7.1 out of a possible maximum score of 10 (71%) with a standard deviation of 2.5. The mean Rhyme Recognition in Sentences raw score for the kindergarten group was 9.1 out of a possible maximum score of 10 (91%) with a standard deviation of 1.1.

Table 3.11 Descriptive Statistics of Rhyme Recognition in Sentences

Group	Mean	Standard Deviation	Minimum	Maximum
Preschool	7.1	2.5	4	10
Kindergarten	9.1	1.1	7	10

Rhyme recognition in words

The mean Rhyme Recognition in Words raw score for the preschool group was 7.4 out of a possible maximum score of 10 (74%) with a standard deviation of 2.6. The mean Rhyme Recognition in Words raw score for the kindergarten group was 9.5 out of a possible maximum score of 10 (95%) with a standard deviation of 0.7.

Table 3.12 Descriptive Statistics of Rhyme Recognition in Words

Group	Mean	Standard Deviation	Minimum	Maximum
Preschool	7.4	2.6	4	10
Kindergarten	9.5	0.7	8	10

Rhyme production in words

The mean Rhyme Production in Words raw score for the preschool group was 4.8 out of a possible maximum score of 10 (48%) with a standard deviation of 4.2. The mean Rhyme Production in Words raw score for the kindergarten group was 9.0 out of a possible maximum score of 10 (90%) with a standard deviation of 1.1. The mean Rhyme Production in Words raw score for the first grade group was 9.3 out of a possible maximum score of 10 (93%) with a standard deviation of 0.8.

Table 3.13 Descriptive Statistics of Rhyme Production in Words

Group	Mean	Standard Deviation	Minimum	Maximum
Preschool	4.8	4.2	0	10
Kindergarten	9.0	1.1	7	10
First Grade	9.3	0.8	8	10

Rhyme production in sentences

The mean Rhyme Production in Sentences raw score for the preschool group was 5.8 out of a possible maximum score of 10 (71%) with a standard deviation of 4.5. The mean Rhyme Production in Sentences raw score for the kindergarten group was 8.9 out of a possible maximum score of 10 (91%) with a standard deviation of 1.6. The mean Rhyme Production in Sentences raw score for the first grade group was 9.5 out of a possible maximum score of 10 (88%) with a standard deviation of 0.7.

Table 3.14 Descriptive Statistics of Rhyme Production in Sentences

Group	Mean	Standard Deviation	Minimum	Maximum
Preschool	5.8	4.5	0	10
Kindergarten	8.9	1.6	6	10
First Grade	9.5	0.7	8	10

Rhyme odd man out: auditory-only

The mean Rhyme Odd Man Out: Auditory-only raw score for the preschool group was 5.2 out of a possible maximum score of 10 (52%) with a standard deviation of 2.9. The mean Rhyme Odd man Out: Auditory-only raw score for the kindergarten group was 6.5 out of a possible maximum score of 10 (65%) with a standard deviation of 1.9. The mean Rhyme Odd man Out: Auditory-only raw score for the first grade group was 7.8 out of a possible maximum score of 10 (78%) with a standard deviation of 1.9.

Table 3.15 Descriptive Statistics of Rhyme Odd Man Out: Auditory-only

Group	Mean	Standard Deviation	Minimum	Maximum
Preschool	5.2	2.9	1	10
Kindergarten	6.5	1.9	3	10
First Grade	7.8	1.9	3	10

Rhyme odd man out: auditory-visual

The mean Rhyme Odd Man Out: Auditory-Visual raw score for the preschool group was 5.7 out of a possible maximum score of 10 (57%) with a standard deviation of 3.1. The mean Rhyme Odd Man Out: Auditory-Visual raw score for the kindergarten group was 8.5 out of a possible maximum score of 10 (85%) with a standard deviation of 1.4. The mean Rhyme Odd Man Out: Auditory-Visual raw score for the first grade group was 9.2 out of a possible maximum score of 10 (82%) with a standard deviation of 1.4.

Table 3.16 Descriptive Statistics of Rhyme Odd Man Out: Auditory-Visual

Group	Mean	Standard Deviation	Minimum	Maximum
Preschool	5.7	3.1	2	10
Kindergarten	8.5	1.4	6	10
First Grade	9.2	1.4	5	10

Rhyme in story with nonsense words

The mean Rhyme in Story with Nonsense Words raw score for the preschool group was 1.9 out of a possible maximum score of 5 (38%) with a standard deviation of 1.8. The mean Rhyme in Story with Nonsense Words raw score for the kindergarten group was 4.2 out of a possible maximum score of 5 (84%) with a standard deviation of 1.0. The mean Rhyme in Story with Nonsense Words raw score for the first grade group was 4.2 out of a possible maximum score of 5 (83%) with a standard deviation of 0.8.

Table 3.17 Descriptive Statistics of Rhyme in Story with Nonsense Words

Group	Mean	Standard Deviation	Minimum	Maximum
Preschool	1.9	1.8	0	5
Kindergarten	4.2	1.0	2	5
First Grade	4.2	0.8	3	5

Alliteration odd man out: auditory-only

The mean Alliteration Odd Man Out: Auditory-only raw score for the preschool group was 4.8 out of a possible maximum score of 10 (48%) with a standard deviation of 2.5. The mean Alliteration Odd Man Out: Auditory-only raw score for the kindergarten group was 6.5 out of a possible maximum score of 10 (65%) with a standard deviation of 2.5. The mean Alliteration Odd Man Out: Auditory-only raw score for the first grade group was 7.8 out of a possible maximum score of 10 (78%) with a standard deviation of 1.9.

Table 3.18 Descriptive Statistics of Alliteration Odd Man Out: Auditory-only

Group	Mean	Standard Deviation	Minimum	Maximum
Preschool	4.8	2.5	1	9
Kindergarten	6.5	2.5	2	10
First Grade	7.8	1.9	4	10

Alliteration odd man out: auditory-visual

The mean Alliteration Odd Man Out: Auditory-Visual raw score for the preschool group was 4.9 out of a possible maximum score of 10 (49%) with a standard deviation of 3.2. The mean Alliteration Odd Man Out: Auditory-Visual raw score for the kindergarten group was 8.2 out of a possible maximum score of 10 (82%) with a standard deviation of 1.5. The mean Alliteration Odd Man Out: Auditory-Visual raw score for the first grade group was 9.2 out of a possible maximum score of 10 (92%) with a standard deviation of 1.3.

Table 3.19 Descriptive Statistics of Alliteration Odd Man Out: Auditory-Visual

Group	Mean	Standard Deviation	Minimum	Maximum
Preschool	4.9	3.2	1	10
Kindergarten	8.2	1.5	6	10
First Grade	9.2	1.3	6	10

Phonemic Awareness

Elision

The mean Elision raw score for the preschool group was 4.0 out of a possible maximum score of 10 (40%) with a standard deviation of 2.9. The mean Elision raw score for the kindergarten group was 6.4 out of a possible maximum score of 10 (64%) with a standard deviation of 2.0. The mean Elision score for the first grade group was 8.2 out of a possible maximum score of 10 (82%) with a standard deviation of 1.4.

Table 3.20 Descriptive Statistics of Elision

Group	Mean	Standard Deviation	Minimum	Maximum
Preschool	4.0	2.9	0	8
Kindergarten	6.4	2.0	2	9
First Grade	8.2	1.4	6	10

Phonics principles

The mean Phonics Principles raw score for the preschool group was 10.7 out of a possible maximum score of 24 (45%) with a standard deviation of 6.7. The mean Phonics Principles raw score for the kindergarten group was 19.7 out of a possible maximum score of 24 (82%) with a standard deviation of 3.5. The mean Phonics Principles raw score for the first grade group was 21.5 out of a possible maximum score of 39 (90%) with a standard deviation of 2.4.

Table 3.21 Descriptive Statistics of Phonics Principles

Group	Mean	Standard Deviation	Minimum	Maximum
Preschool	10.7	6.7	3	24
Kindergarten	19.7	3.5	13	24
First Grade	21.5	2.4	16	24

Invented spelling

The mean Invented Spelling raw score for the kindergarten group was 33.5 out of a possible maximum score of 20 (67%) with a standard deviation of 5.3. The mean Invented Spelling raw score for the first grade group was 45.2 out of a possible maximum score of 20 (90%) with a standard deviation of 3.6.

Table 3.22 Descriptive Statistics of Invented Spelling

Group	Mean	Standard Deviation	Minimum	Maximum
Kindergarten	33.5	5.3	25	39
First Grade	45.2	3.6	37	50

Word/nonsense word recognition

Sight word recognition. The mean Sight Word Recognition raw score for the kindergarten group was 7.6 out of a possible maximum score of 14 (54%) with a standard deviation of 3.9. The mean Sight Word Recognition raw score for the first grade group was 13.8 out of a possible maximum score of 14 (98%) with a standard deviation of 0.6.

Table 3.23 Descriptive Statistics of Sight Word Recognition

Group	Mean	Standard Deviation	Minimum	Maximum
Kindergarten	7.6	3.9	2	13
First Grade	13.8	0.6	12	14

Reading nonsense words. The mean Reading Nonsense Words raw score for the kindergarten group was 4.2 out of a possible maximum score of 14 (30%) with a standard deviation of 2.7. The mean Reading Nonsense Words raw score for the first grade group was 8.1 out of a possible maximum score of 14 (58%) with a standard deviation of 2.9.

Table 3.24 Descriptive Statistics of Reading Nonsense Words

Group	Mean	Standard Deviation	Minimum	Maximum
Kindergarten	4.2	2.7	0	9
First Grade	8.1	2.9	4	14

Spelling recognition

The mean Spelling Recognition raw score for the first grade group was 8.8 out of a possible maximum score of 10 (88%) with a standard deviation of 0.7.

Table 3.25 Descriptive Statistics of Spelling Recognition

Group	Mean	Standard Deviation	Minimum	Maximum
First Grade	8.8	0.7	7	10

Graphic concepts

Copying geometric forms and letters. The mean Copying Geometric Forms and Letters raw score for the preschool group was 5.7 out of a possible maximum score of 4

(71%) with a standard deviation of 2.0. The mean Copying Geometric Forms and Letters raw score for the kindergarten group was 6.0 out of a possible maximum score of 4 (75%) with a standard deviation of 1.8.

Table 3.26 Descriptive Statistics of Copying Shape and Letters

Group	Mean	Standard Deviation	Minimum	Maximum
Preschool	5.7	2.0	1	8
Kindergarten	6.0	1.8	2	8

Copying words and sentences. The mean Copying Words and Sentences raw score for the first grade group was 13.4 out of a possible maximum score of 16 (84%) with a standard deviation of 2.3.

Table 3.27 Descriptive Statistics of Copying Words and Sentences

Group	Mean	Standard Deviation	Minimum	Maximum
First Grade	13.4	2.3	8	16

Summary of descriptive data for written language composite

On the written language tests, the preschool children performed with 70% accuracy, the kindergarten children performed with 88% accuracy and the first grade children performed with 95% accuracy. On all tests of written language, with the exception of two tests, first graders had higher mean scores than kindergarteners and kindergartens had higher mean scores than preschoolers; however, these differences were very slight in some cases. Kindergarten and first grade children had identical mean scores on 1) identifying beginning and ending of sentences and 2) rhyme in story with nonsense words.

Descriptive Analysis: Spoken Language Domain

The mean composite Spoken Language domain raw score for the preschool group was 70.6 (71.3%) with a standard deviation of 11.0. The mean composite Spoken

Language domain raw score for the kindergarten group was 82.2 (83%) with a standard deviation of 8.5. The mean composite Spoken Language domain raw score for the first grade group was 88.2 (89.1) with a standard deviation of 8.5.

Table 3.28 Descriptive Statistics of Spoken Language domain

Group	Mean	Standard Deviation	Minimum	Maximum
Preschool	70.6	11.0	54	83
Kindergarten	82.2	8.5	63	93
First Grade	88.2	8.5	83	95

As shown in figure 3.3 below there is no overlap of spoken composite scores for the top quartile for the preschool group and bottom quartile for the kindergarten group. In addition, there is no overlap of the spoken composites scores for the top quartile for the preschool group and the bottom quartile for the first grade group. Some overlap is observed between the top quartile for the kindergarten group and the bottom quartile for the first grade group.

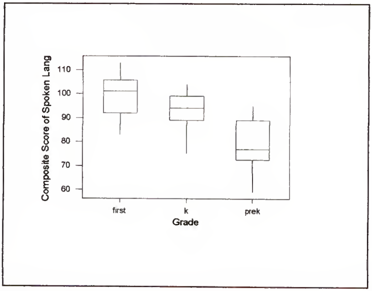


Figure 3.3 Box plots of Composite Score of Spoken Language by Grade

Receptive Language

Receptive vocabulary

The mean Receptive Vocabulary raw score for the preschool group was 17.0 out of a possible maximum score of 24 (81%) with a standard deviation of 2.6. The mean Receptive Vocabulary raw score for the kindergarten group was 18.5 out of a possible maximum score of 24 (88%) with a standard deviation of 0.9. The mean Receptive Vocabulary score for the first grade group was 20.2 out of a possible maximum score of 24 (96%) with a standard deviation of 0.6.

Table 3.29 Descriptive Statistics of Receptive Vocabulary

Group	Mean	Standard Deviation	Minimum	Maximum
Preschool	17.0	2.6	14	21
Kindergarten	18.5	0.9	17	20
First Grade	20.2	0.6	19	21

Lexical order

The mean Lexical Order raw score for the preschool group was 8.4 out of a possible maximum score of 10 (84%) with a standard deviation of 1.4. The mean Lexical Order raw score for the kindergarten group was 8.5 out of a possible maximum score of 10 (85%) with a standard deviation of 1.2. The mean Lexical Order score for the first grade group was 9.3 out of a possible maximum score of 10 (93%) with a standard deviation of 0.8.

Table 3.30 Descriptive Statistics of Lexical Order

Group	Mean	Standard Deviation	Minimum	Maximum
Preschool	8.4	1.4	6	10
Kindergarten	8.5	1.2	6	10
First Grade	9.3	0.8	8	10

Morphological familiarity

The mean Morphological Familiarity raw score for the preschool group was 5.9 out of a possible maximum score of 10 (66%) with a standard deviation of 2.3. The mean Morphological Familiarity raw score for the kindergarten group was 6.9 out of a possible maximum score of 10 (77%) with a standard deviation of 2.3. The mean Morphological Familiarity score for the first grade group was 8.5 out of a possible maximum score of 10 (95%) with a standard deviation of 0.7.

Table 3.31 Descriptive Statistics of Morphological Familiarity

Group	Mean	Standard Deviation	Minimum	Maximum
Preschool	5.9	2.3	3	9
Kindergarten	6.9	2.3	2	9
First Grade	8.5	0.7	7	9

Receptive: spatial-temporal concepts

The mean Receptive: Spatial-Temporal Concepts raw score for the preschool group was 7.7 out of a possible maximum score of 10 (77%) with a standard deviation of 1.5. The mean Receptive: Spatial-Temporal Concepts raw score for the kindergarten group was 8.0 out of a possible maximum score of 10 (80%) with a standard deviation of 1.4. The mean Receptive: Spatial-Temporal Concepts raw score for the first grade group was 8.8 out of a possible maximum score of 10 (88%) with a standard deviation of 1.0.

Table 3.32 Descriptive Statistics of Receptive: Spatial-Temporal Concepts

Group	Mean	Standard Deviation	Minimum	Maximum
Preschool	7.7	1.5	5	10
Kindergarten	8.0	1.4	5	9
First Grade	8.8	1.0	7	10

Listening comprehension

The mean Listening Comprehension raw score for the preschool group was 2.6 out of a possible maximum score of 4 (65%) with a standard deviation of 1.0. The mean Listening Comprehension raw score for the kindergarten group was 2.4 out of a possible maximum score of 4 (59%) with a standard deviation of 1.2. The mean Listening Comprehension raw score for the first grade group was 2.8 out of a possible maximum score of 4 (71%) with a standard deviation of 1.0.

Table 3.33 Descriptive Statistics of Listening Comprehension

Group	Mean	Standard Deviation	Minimum	Maximum
Preschool	2.6	1.0	1	4
Kindergarten	2.4	1.2	1	4
First Grade	2.8	1.0	1	4

Note: Preschool and kindergarten children answered questions about a story that was different from the story told to the first grade children

Expressive Language

Parallel sentence production

The mean Parallel Sentence Production raw score for the preschool group was 17.1 out of a possible maximum score of 30 (57%) with a standard deviation of 3.0. The mean Parallel Sentence Production raw score for the kindergarten group was 23.7 out of a possible maximum score of 30 (79%) with a standard deviation of 3.1. The mean Parallel Sentence Production raw score for the first grade group was 24.2 out of a possible maximum score of 30 (81%) with a standard deviation of 2.5.

Table 3.34 Descriptive Statistics of Parallel Sentence Production

Group	Mean	Standard Deviation	Minimum	Maximum
Preschool	17.1	3.0	12	21
Kindergarten	23.7	3.1	18	29
First Grade	24.2	2.5	20	27

Definitions

The mean Definitions raw score for the kindergarten group was 3.5 out of a possible maximum score of 5 (70%) with a standard deviation of 1.5. The mean Definitions raw score for the first grade group was 4.2 out of a possible maximum score of 5 (83%) with a standard deviation of 1.0.

Table 3.35 Descriptive Statistics of Definitions

Group	Mean	Standard Deviation	Minimum	Maximum
Kindergarten	3.5	1.5	1	5
First Grade	4.2	1.0	2	5

Synonyms

The mean synonyms raw score for the first grade group was 4.5 out of a possible maximum score of 10 (45%) with a standard deviation of 2.1.

Table 3.36 Descriptive Statistics of Synonyms

Group	Mean	Standard Deviation	Minimum	Maximum
First Grade	4.5	2.1	0	7

Verbal analogies

The mean Verbal Analogies raw score for the preschool group was 8.6 out of a possible maximum score of 10 (86%) with a standard deviation of 2.0. The mean Verbal Analogies raw score for the kindergarten group was 9.5 out of a possible maximum score of 10 (95%) with a standard deviation of 0.7. The mean Verbal Analogies raw score for the first grade group was 9.5 out of a possible maximum score of 10 (95%) with a standard deviation of 0.7.

Table 3.37 Descriptive Statistics of Verbal Analogies

Group	Mean	Standard Deviation	Minimum	Maximum
Preschool	8.6	2.0	4	10
Kindergarten	9.5	0.7	8	10
First Grade	9.5	0.7	8	10

Expressive: spatial-temporal concepts

The mean Expressive: Spatial-Temporal Concepts raw score for the preschool group was 5.9 out of a possible maximum score of 9 (66%) with a standard deviation of 1.3. The mean Expressive: Spatial-Temporal Concepts raw score for the kindergarten group was 6.9 out of a possible maximum score of 9 (77%) with a standard deviation of 1.7. The mean Expressive: Spatial-Temporal Concepts raw score for the first grade group was 7.6 out of a possible maximum score of 9 (85%) with a standard deviation of 1.3.

Table 3.38 Descriptive Statistics of Expressive: Spatial-Temporal Concepts

Group	Mean	Standard Deviation	Minimum	Maximum
Preschool	5.9	1.3	3	8
Kindergarten	6.9	1.7	4	9
First Grade	7.6	1.3	5	9

Storytelling

The mean Storytelling raw score for the preschool group was 2.7 out of a possible maximum score of 4 (68%) with a standard deviation of 0.9. The mean Storytelling raw score for the kindergarten group was 3.2 out of a possible maximum score of 4 (80%) with a standard deviation of 0.8. The mean Storytelling raw score for the first grade group was 3.1 out of a possible maximum score of 4 (77%) with a standard deviation of 1.0.

Table 3.39 Descriptive Statistics of Storytelling

Group	Mean	Standard Deviation	Minimum	Maximum
Preschool	2.7	0.9	1	4
Kindergarten	3.2	0.8	2	4
First Grade	3.1	1.0	1	4

Note: Preschool and kindergarten children told a story that was different from the story told by the first grade children

Rapid naming

Rapid object naming. The mean Rapid Object Naming time for the preschool group was 189.7 with a standard deviation of 43.2. The mean Rapid Object Naming time for the kindergarten group was 142.9 with a standard deviation of 47.7. The mean Rapid Object Naming time for the first grade group was 109.7 with a standard deviation of 26.4.

Table 3.40 Descriptive Statistics of Rapid Object Naming time

Group	Mean	Standard Deviation	Minimum	Maximum
Preschool	189.7	43.2	104	262
Kindergarten	142.9	47.7	84	225
First Grade	109.7	26.4	82	173

Rapid color naming. The mean Rapid Color Naming time for the preschool group was 191.9 with a standard deviation of 40.8. The mean Rapid Color Naming time for the kindergarten group was 145.1 with a standard deviation of 49.4. The mean Rapid Color Naming time for the first grade group was 103.8 with a standard deviation of 32.0.

Table 3.41 Descriptive Statistics of Rapid Color Naming time

Group	Mean	Standard Deviation	Minimum	Maximum
Preschool	191.9	40.8	110	236
Kindergarten	145.1	49.4	89	274
First Grade	103.8	32.0	72	183

Word retrieval. The mean Word Retrieval raw score for the preschool group was 8.6 with a standard deviation of 2.8. The mean Word Retrieval raw score for the kindergarten group was 10.8 with a standard deviation of 4.1. The mean Word Retrieval raw score for the first grade group was 12.8 with a standard deviation of 4.2.

Table 3.42 Descriptive Statistics of Word Retrieval

Group	Mean	Standard Deviation	Minimum	Maximum
Preschool	8.6	2.8	4	12
Kindergarten	10.8	4.1	6	20
First Grade	12.8	4.2	7	21

Summary of descriptive data for the spoken language composite

On the tests of spoken language production (as noted above, word retrieval scores eliminated), the preschool children performed with 71.3% accuracy, the kindergarten children performed with 83% accuracy and the first grade children performed with 89.1 % accuracy. Again for the of spoken language with the exception of two tests, first graders had higher mean scores than kindergarteners and kindergartens had higher mean scores than preschoolers; however, these differences were very slight in some cases. On the test of listening comprehension, kindergartners had slightly lower scores than preschool children. The first graders had the highest mean score, however, they listened to a different story and hence cannot be compared to the two younger groups. Also on the test of Verbal Analogies, the kindergarten and first grade children had identical mean scores. Differences in means among the three groups of children were most marked for the naming tasks.

Descriptive Analysis: Speech Production Domain

The mean composite Speech Production domain raw score for the preschool group was 47.0 out of a possible maximum score of 54 (87%) with a standard deviation of 4.4. The mean composite Speech Production domain raw score for the kindergarten group was 49.0 out of a possible maximum score of 54 (91%) with a standard deviation of 3.1. The mean composite Speech Production domain raw score for the first grade group was 52.1 out of a possible maximum score of 54 (96%) with a standard deviation of 2.0.

Table 3.43 Descriptive Statistics of Speech Production Domain

Group	Mean	Standard Deviation	Minimum	Maximum
Preschool	47.0	4.4	37	52
Kindergarten	49.0	3.1	43	53
First Grade	52.1	2.0	48	54

As shown in figure 3.4 below there is overlap of speech production composite scores for the top quartile for the preschool group and bottom quartile for the kindergarten group. However, there is no overlap of the speech production composites scores for the top quartile for the preschool group and the bottom quartile for the first grade group. Some overlap is observed between the top quartile for the kindergarten group and the bottom quartile for the first grade group.

Sounds in Words

The mean Sounds in Words raw score for the preschool group was 31.9 out of a possible maximum score of 34 (94%) with a standard deviation of 3.4. The mean Sounds in Words raw score for the kindergarten group was 31.3 out of a possible maximum score of 34 (92%) with a standard deviation of 3.1. The mean Sounds in Words raw score for the first grade group was 33.5 out of a possible maximum score of 34 (99%) with a standard deviation of 0.7.

Complex Speech Production

The mean Complex Speech Production raw score for the preschool group was 6.8 out of a possible maximum score of 10 (68%) with a standard deviation of 1.9. The mean Complex Speech Production raw score for the kindergarten group was 8.3 out of a possible maximum score of 10 (83%) with a standard deviation of 1.3. The mean Complex Speech Production raw score for the first grade group was 8.6 out of a possible maximum score of 10 (86%) with a standard deviation of 1.7.

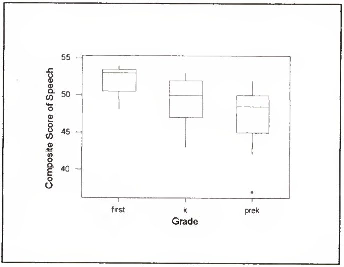


Figure 3.4 Box plots of Composite Score of Speech Production by Grade

Table 3.44 Descriptive Statistics of Sounds in Words

Group	Mean	Standard Deviation	Minimum	Maximum
Preschool	31.9	3.4	23	34
Kindergarten	31.3	3.1	24	34
First Grade	33.5	0.7	32	34

Table 3.45 Descriptive Statistics of Complex Speech Production

Group	Mean	Standard Deviation	Minimum	Maximum
Preschool	6.8	1.9	4	9
Kindergarten	8.3	1.3	6	10
First Grade	8.6	1.7	5	10

Pseudoword Repetition

The mean Pseudoword Repetition raw score for the preschool group was 8.3 out of a possible maximum score of 10 (83%) with a standard deviation of 1.3. The mean Pseudoword Repetition raw score for the kindergarten group was 9.5 out of a possible maximum score of 10 (95%) with a standard deviation of 0.5. The mean Pseudoword

Repetition raw score for the first grade group was 9.9 out of a possible maximum score of 10 (99%) with a standard deviation of 0.3.

Table 3.46 Descriptive Statistics of Pseudoword Repetition

Group	Mean	Standard Deviation	Minimum	Maximum
Preschool	8.3	1.3	6	10
Kindergarten	9.5	0.5	9	10
First Grade	9.9	0.3	9	10

Summary of descriptive data for speech production

On the tests of speech production, the preschool children performed with 87 % accuracy, the kindergarten children performed with 91 % accuracy and the first grade children performed with 96 % accuracy. For two of the three tests in the speech production composite first graders had higher mean scores than kindergarteners and kindergartens had higher mean scores than preschoolers; however, these differences were very slight in some cases. On the sounds in words test the preschool children had a very slightly higher mean score that the kindergarten group.

Overall Summary of Descriptive Data

As expected there was a consistent trend for the older children do perform with greater accuracy than the younger children on the tests across all domains (written, spoken, and speech) that were administered to each grade level. Table 3.49 below shows these data for the composite L3 score and for the composite scores for each of the three domains.

Table 3.47 Percentage of Items Correct by Grade Level for Composite Scores

	Preschool	Kindergarten	First Grade
L3 composite	70%	88%	95%
Written Language	59%	85%	91%
Spoken Language	71%	83%	89%
Speech Production	87%	91%	96%

Comparative Findings Across Three Grades: L3 Composite

Significant difference was found between the kindergarten group and the preschool group ($F=7.82$, $p<.0001$; $t=4.60$, $p<0.001$), and between the first grade group and the preschool group ($F=7.82$, $p<.0001$; $t=5.61$, $p<0.001$). However, a significant difference was not found between the first grade group and the kindergarten group ($F=7.82$, $p<.0001$; $t=0.81$, $p=0.43$).

Comparative Findings: Written Language Domain

Significant difference was found between the kindergarten group and the preschool group ($F=7.92$, $p<0.0001$; $t=4.70$, $p<0.001$), and between the first grade group and the preschool group ($F=7.92$, $p<0.0001$; $t=5.28$, $p<0.001$). However, a significant difference was not found between the first grade group and the kindergarten group ($F=7.92$, $p<0.0001$; $t=0.38$, $p=0.71$).

Print Concepts

Letter discrimination

Significant difference was not between the kindergarten group and the preschool group ($t=1.96$, $p=0.07$).

Visual matching

Significant difference was found between the first grade group and the kindergarten group ($F=5.46$, $p=0.0008$; $t=2.07$, $p=0.048$), between the kindergarten group and the preschool group (F=5.46, p=0.0008; t=2.49, p=0.019) and between the first grade group and the preschool group (F=5.46, p=0.0008; t=4.65, p<0.001).

Identifying beginning and ending of sentence

Significant difference was not found between the first grade group and the kindergarten group (F=0.64, p=0.6992; t=0.34, p=0.734), between the kindergarten group and the preschool group (F=0.64, p=0.6992; t=1.14, p=0.264) or between the first grade group and the preschool group (F=0.64, p=0.6992; t=1.53, p=0.137).

Alphabet knowledge

The subtest consists of Letter Recognition, Letter Naming, Name Writing, and Letter Production.

Letter recognition. Significant difference was found between the kindergarten group and the preschool group (F=8.92, p<0.0001; t=4.61, p<0.001), and between the first grade group and the preschool group (F=8.92, p<0.0001; t=4.9, p<0.001). However, a significant difference was not found between the first grade group and the kindergarten group (F=8.92, p<0.0001; t=0.08, p=0.938).

Letter naming. Significant difference was found between the kindergarten group and the preschool group (F=4.96, p=0.0015; t=4.14, p<0.001), and between the first grade group and the preschool group (F=4.96, p=0.0015; t=4.18, p<0.001). However, a significant difference was not found between the first grade group and the kindergarten group (F=4.96, p=0.0015; t=-0.15, p=0.884).

Name writing. Statistical analyses were not performed to assess differences between the kindergarten group and the preschool group because a binary scoring system (0,1) was used and most children obtained the maximum score of 1.

Letter production. Significant difference was found between the kindergarten group and the preschool group (F=1.99, p=0.1063; t=2.53, p=0.019), and between the first grade group and the preschool group (F=1.99, p=0.1063; t=2.16, p=0.014). However, a significant difference was not found between the first grade group and the kindergarten group (F=1.99, p=0.1063; t=0.20, p=0.84).

Concept of word

Significant difference was found between the kindergarten group and the preschool group (F=12.28, p<0.0001; t=6.64, p<0.001), and between the first grade group and the preschool group (F=12.28, p<0.0001; t=7.37, p<0.001). However, a significant difference was not found between the first grade group and the kindergarten group (F=12.28, p<0.0001; t=0.43, p=0.671).

Phonological Awareness Concepts

Rhyme recognition in sentences

Significant difference was found between the kindergarten group and the preschool group (t=2.40, p=0.033).

Rhyme recognition in words

Significant difference was found between the kindergarten group and the preschool group (t=2.38, p=0.031).

Rhyme production in words

Significant difference was not found between the first grade group and the kindergarten group (F=4.30, p=0.0036; t=-0.04, p=0.966), or between the first grade group and the preschool group (F=4.30, p=0.0036; t=1.95, p=0.067). However, a significant difference was found between the kindergarten group and the preschool group (F=4.30, p=0.0036; t=2.61, p=0.018).

Rhyme production in sentences

Significant difference was found between the kindergarten group and the preschool group (F=2.15, p=0.0798; t=2.55, p=0.017), and between the first grade group and the preschool group (F=2.15, p=0.0798; t=2.94, p=0.007). However, a significant difference was not found between the first grade group and the kindergarten group (F=2.15, p=0.0798; t=0.29, p=0.775).

Rhyme odd man out: auditory-only

Significant difference was not found between the first grade group and the kindergarten group (F=1.81, p=0.1340; t=0.82, p=0.421), or between the kindergarten group and the preschool group (F=1.81, p=0.1340; t=1.73, p=0.10). However, a significant difference was found between the first grade group and the preschool group (F=1.81, p=0.1340; t=2.61, p=0.015).

Rhyme odd man out: auditory-visual

Significant difference was found between the kindergarten group and the preschool group (F=5.25, p=0.0011; t=3.78, p<0.001), and between the first grade group and the preschool group (F=5.25, p=0.0011; t=4.12, p<0.001). However, a significant difference was not found between the first grade group and the kindergarten group (F=5.25, p=0.0011; t=0.17, p=0.864).

Rhyme in story with nonsense words

Significant difference was found between the kindergarten group and the preschool group (F=5.10, p=0.0014; t=4.3, p<0.001), and between the first grade group and the preschool group (F=5.10, p=0.0014t=3.84, p<0.001). However, a significant difference was not found between the first grade group and the kindergarten group (F=5.10, p=0.0014t=-0.56, p=0.578).

Alliteration odd man out: auditory-only

Significant difference was found between the kindergarten group and the preschool group (F=3.13, p=0.0185; t=2.23, p=0.04), and between the first grade group and the preschool group (F=3.13, p=0.0185; t=2.82, p<0.001). However, a significant difference was not found between the first grade group and the kindergarten group (F=3.13, p=0.0185; t=0.60, p=0.553).

Alliteration odd man out: auditory-visual

Significant difference was found between the kindergarten group and the preschool group (F=6.18, p=0.0004; t=3.87, p<0.001), and between the first grade group and the preschool group (F=6.18, p=0.0004; t=4.75, p<0.001). However, a significant difference was not found between the first grade group and the kindergarten group (F=6.18, p=0.0004; t=0.72, p=0.48).

Phonemic Awareness

Elision

Significant difference was found between the kindergarten group and the preschool group (F=4.39, p=0.0032; t=2.73, p=0.011), and between the first grade group and the preschool group (F=4.39, p=0.0032; t=4.3, p<0.001). However, a significant difference was not found between the first grade group and the kindergarten group (F=4.39, p=0.0032; t=1.47, p=0.151).

Phonics principles

Significant difference was found between the kindergarten group and the preschool group ($t=4.13$, $p<0.001$), and between the first grade group and the preschool group ($t=4.99$, $p<0.001$). However, a significant difference was not found between the first grade group and the kindergarten group ($t=0.50$, $p=0.623$).

Invented spelling

Significant difference was found between the first grade group and the kindergarten group ($t=6.47$, $p<0.001$).

Word/nonsense word recognition

Sight word recognition. Significant difference was found between the first grade group and the kindergarten group ($t=5.03$, $p=<0.001$).

Reading nonsense words. Significant difference was found between the first grade group and the kindergarten group ($t=3.04$, $p=0.003$).

Graphic Concepts: Geometric Forms and Letters

Significant difference was not found between the kindergarten group and the preschool group ($t=0.9$, $p=0.38$).

Comparative Findings: Spoken Language Domain

Significant differences were found between the kindergarten group and the preschool group ($F=4.71$, $p=0.0021$; $t=3.56$, $p=0.001$), and between the first grade group and the preschool group ($F=4.71$, $p=0.0021$; $t=4.71$, $p<0.001$). However, a significant differences were not found between the first grade group and the kindergarten group ($F=4.71$, $p=0.0021$; $t=1.01$, $p=0.32$).

Receptive Language

Receptive vocabulary

Significant difference was found between the kindergarten group and the preschool group (F=5.76, p=0.0006; t=2.39, p=0.024), and between the first grade group and the preschool group (F=5.76, p=0.0006; t=1.91, p=0.067). However, a significant difference was not found between the first grade group and the kindergarten group (F=5.76, p=0.0006; t=4.38, p<0.001).

Lexical order

Significant difference was not found between the first grade group and the kindergarten group (F=0.69, p=0.6565; t=1.49, p=0.146), between the kindergarten group and the preschool group (F=0.69, p=0.6565; t=0.22, p=0.825) or between the first grade group and the preschool group (F=0.69, p=0.6565; t=0.17, p=0.10).

Morphological familiarity

Significant difference was found between the kindergarten group and the preschool group (F=5.87, p=0.0005; t=2.1, p=0.045), and between the first grade group and the preschool group (F=5.87, p=0.0005; t=3.7, p<0.001). However, a significant difference was not found between the first grade group and the kindergarten group (F=5.87, p=0.0005; t=1.55, p=0.132).

Receptive: spatial-temporal concepts

Significant difference was not found between the first grade group and the kindergarten group (F=2.70, p=0.0348; t=0.98, p=0.336), between the kindergarten group and the preschool group (F=2.70, p=0.0348; t=0.99, p=0.330) or between the first grade group and the preschool group (F=2.70, p=0.0348; t=2.00, p=0.056).

Listening comprehension

Significant difference was not found between the kindergarten group and the preschool group (t=-0.25, p=0.808).

Expressive Language

Parallel sentence production

Significant difference was found between the kindergarten group and the preschool group (F=7.77, p<0.0001; t=5.49, p<0.001), and between the first grade group and the preschool group (F=7.77, p<0.0001; t=5.94, p<0.001). However, a significant difference was not found between the first grade group and the kindergarten group (F=7.77, p<0.0001; t=0.21, p=0.839).

Definitions

Significant difference was found between the first grade group and the kindergarten group (t=1.4, p=0.17).

Verbal analogies

Significant difference was not found between the first grade group and the kindergarten group (F=1.28, p=0.3002; t=-0.046, p=0.964), between the kindergarten group and the preschool group (F=1.28, p=0.3002; t=1.92, p=0.065) or between the first grade group and the preschool group (F=1.28, p=0.3002; t=1.96, p=0.06).

Expressive: spatial-temporal concepts

No significant difference was found between the first grade group and the kindergarten group (F=3.19, 0.0168; t=.55, p=.58), or between the preschool group and the kindergarten group (F=3.19, 0.0168; t=.55, p=.587). However, a significant difference was found between the first grade group and the preschool group (F=3.19, 0.0168; t=2.84, p=.008).

Storytelling

Significant difference was found between the kindergarten group and the preschool group (t=1.53, p=0.146).

Rapid naming

Rapid object naming. Significant difference was found between the first grade group and the kindergarten group (F=4.04; p=0.0051; t=-2.18, p=0.038), between the kindergarten group and the preschool group (F=4.04; p=0.0051; t=-2.39, p=0.023) and between the first grade group and the preschool group (F=4.04; p=0.0051; t=-4.65, p<0.001).

Rapid color naming. Significant difference was found between the first grade group and the kindergarten group (F=4.52, p=0.0027; t=-2.48, p=0.020), between the kindergarten group and the preschool group (F=4.52, p=0.0027; t=-2.43, p=0.022) and between the first grade group and the preschool group (F=4.52, p=0.0027; t=-4.99, p<0.001).

Word retrieval. Significant difference was not found between the first grade group and the kindergarten group (F=1.25, p=0.3172; t=1.12, p=0.272), or between the kindergarten group and the preschool group (F=1.25, p=0.3172; t=1.13, p=0.229). However, a significant difference was found between the first grade group and the preschool group (F=1.25, p=0.3172; t=2.35, p=0.027).

Comparative Findings: Speech Production Domain

Significant differences were found between the first grade group and the kindergarten group (F=2.49, p=0.0475; t=2.21, p=0.03), and between the first grade group and the preschool group (F=2.49, p=0.0475; t=3.57, p=0.001). However, significant differences were not found between the kindergarten group and the preschool group (F=2.49, p=0.0475; t=1.33, p=0.19).

Sounds in Words

Significant difference was not found between the kindergarten group and the preschool group (F=1.00, p=0.4461; t=-0.49, p=0.627), or between the first grade group and the preschool group (F=1.00, p=0.4461; t=1.54, p=0.134). However, a significant difference was found between the first grade group and the kindergarten group (F=1.00, p=0.4461; t=2.09, p=0.046).

Complex Speech Production

Significant difference was not found between the first grade group and the kindergarten group (F=1.43, p=0.2409; t=0.40, p=0.693), or between the kindergarten group and the preschool group (F=1.43, p=0.2409; t=1.73, p=0.094). However, a significant difference was found between the first grade group and the preschool group (F=1.43, p=0.2409; t=2.20, p=0.036).

Pseudoword Repetition

Significant difference was found between the kindergarten group and the preschool group (F=4.32, p=0.0035; t=3.49, p=0.001), and between the first grade group and the preschool group (F=4.32, p=0.0035; t=4.96, p<0.001). However, a significant difference was not found between the first grade group and the kindergarten group (F=4.32, p=0.0035; t=1.34, p=0.191).

Summary of Comparative Data

Anova's performed on tests of written language, spoken language, and speech production were used to compare children at three grade levels, preschool, kindergarten and first grade. A total of 45 tests were given. 44 of these tests were given to at least two of the age groups. The majority of tests were given to all three groups. 29 of the 44 tests showed significant differences between at least two groups. On most tasks where all three groups were tested, differences were found between the preschool and kindergarten children and the preschool and first grade children. Hence, the least number of differences were found between the kindergartners and first grades. Post hoc correlational analyses are contained within Tables 3.50, 3.51, and 3.52 in Appendix B.

Table 3.48 Comparative data for composite scores by grades.

	Preschool		Kindergarten		First grade		Kindergarten-Preschool			First grade-Kindergarten			First grade-Preschool		
Test Name	Mean*	S.E.**	Mean	S.E.	Mean	S.E.	Diff***	t-stat.	p-value	Diff	t-stat.	p-value	Diff	t-stat.	p-value
Total Composite Score	223.7	11.7	291.7	11.1	302.3	11.1	68.0	4.60	<0.001	10.6	0.81	0.43	78.6	5.61	<0.001
Composite Score of Written Language	99.9	8.5	149.7	8	153.4	8	49.8	4.70	<0.001	3.7	0.38	0.71	53.5	5.28	<0.001
Composite Score of Spoken Language	76.6	3.5	92.3	3.3	96.4	3.3	15.7	3.56	0.001	4.1	1.01	0.32	19.8	4.71	<0.001
Composite Score of Speech Production	47.2	1.2	49.3	1.2	52.5	1.2	2.1	1.33	0.19	3.2	2.21	0.03	5.3	3.57	0.001

* Estimated mean with least square method. ** S.E. stands for standard error. *** Diff is difference between two estimated means. The p-value is calculated based on least significance difference method.

Table 3.49 Comparative data for subtest scores by grades.

	Preschool		Kindergarten		First grade		Kindergarten-Preschool			First grade-Kindergarten			First grade-Preschool		
Test Name	Mean*	S.E.**	Mean	S.E.	Mean	S.E.	Diff***	t-stat.	p-value	Diff	t-stat.	p-value	Diff	t-stat.	p-value
Letter Discrimination	20.7	0.94	22.8	0.91	n/a	n/a	2.1	1.96	0.070	n/a	n/a	n/a	n/a	n/a	n/a
Visual Matching	8.1	0.54	9.8	0.51	11.1	0.52	1.7	2.49	0.019	1.3	2.07	0.048	3.0	4.65	<0.001
Identifying Beginning and Ending of Sentences	3.6	0.26	4.0	0.25	4.1	0.25	0.4	1.14	0.264	0.1	0.34	0.734	0.5	1.53	0.137
Letter Recognition	18.2	0.76	22.6	0.71	22.6	0.72	4.4	4.61	<0.001	0.0	0.08	0.938	4.4	4.90	<0.001
Letter Naming	17.0	1.21	23.2	1.14	23.0	1.15	6.2	4.14	<0.001	-0.2	-0.15	0.884	6.0	4.18	<0.001
Name Writing	0.89	0.08	0.98	0.08	n/a	n/a	0.09	0.94	0.362	n/a	n/a	n/a	n/a	n/a	n/a
Letter Production	7.7	1.13	11.3	1.17	11.6	1.15	3.6	2.53	0.019	0.3	0.20	0.840	3.9	2.66	0.014
Concept of Word	2.1	0.40	5.5	0.38	5.7	0.38	3.4	6.64	<0.001	0.2	0.43	0.671	3.6	7.37	<0.001
Rhyme Recognition in Sentences	6.3	0.73	8.4	0.71	n/a	n/a	2.1	2.40	0.033	n/a	n/a	n/a	n/a	n/a	n/a
Rhyme Recognition in Words	6.9	0.71	8.8	0.69	n/a	n/a	1.9	2.38	0.031	n/a	n/a	n/a	n/a	n/a	n/a
Rhyme Production in Words	6.9	0.65	8.8	0.62	8.8	0.96	1.9	2.61	0.018	0.0	-0.04	0.966	1.9	1.95	0.067
Rhyme Production in Sentences	5.7	1.00	8.9	0.95	9.2	0.96	3.2	2.55	0.017	0.3	0.29	0.775	3.5	2.94	0.007
Rhyme Odd Man Out: Auditory-only	4.4	0.84	6.2	0.80	7.1	0.80	1.8	1.73	0.100	0.9	0.82	0.421	2.7	2.61	0.015
Rhyme Odd Man Out: Auditory-Visual	4.9	0.68	8.1	0.65	8.3	0.65	3.2	3.78	<0.001	0.2	0.17	0.864	3.4	4.12	<0.001

	Preschool		Kindergarten		First grade		Kindergarten-Preschool			First grade-Kindergarten			First grade-Preschool		
Rhyme in Story with Nonsense Words	1.5	0.45	3.9	0.42	3.6	0.43	2.5	4.30	<0.001	-0.3	-0.56	0.578	2.2	3.84	<0.001
Alliteration Odd Man Out: Auditory-only	4.3	0.79	6.4	0.75	7.0	0.75	2.1	2.23	0.040	0.6	0.60	0.553	2.7	2.82	<0.001
Alliteration Odd Man Out: Auditory-Visual	3.9	0.73	7.4	0.69	8.1	0.69	3.5	3.87	<0.001	0.7	0.72	0.480	4.2	4.75	<0.001
Elision	3.4	0.79	6.1	0.75	7.5	0.75	2.7	2.73	0.011	1.4	1.47	0.151	4.1	4.30	<0.001
Phonics Principles	9.9	1.63	18.9	1.73	19.9	1.62	9.0	4.13	<0.001	1.0	0.50	0.623	10.0	4.99	<0.001
Invented Spelling	n/a	n/a	33.3	1.66	45.7	1.80	n/a	n/a	n/a	12.4	6.47	<0.001	n/a	n/a	n/a
Sight Word Recognition	n/a	n/a	7.4	1.04	13.7	0.99	n/a	n/a	n/a	6.3	5.03	<0.001	n/a	n/a	n/a
Nonsense Word Recognition	n/a	n/a	3.3	1.02	7.5	0.97	n/a	n/a	n/a	4.2	3.40	0.003	n/a	n/a	n/a
Graphic Concepts: Shapes & Letters	5.8	0.77	6.57	0.75	n/a	n/a	0.8	0.90	0.380	n/a	n/a	n/a	n/a	n/a	n/a
Receptive Vocabulary	16.6	0.55	18.2	0.52	19.5	0.52	1.6	2.39	0.024	1.3	1.91	0.067	2.9	4.38	<0.001
Lexical Order	8.3	0.45	8.44	0.42	9.2	0.43	0.1	0.22	0.825	0.8	1.49	0.146	0.9	1.71	0.100
Morphological Familiarity	4.7	0.57	6.23	0.54	7.3	0.54	1.5	2.10	0.045	1.0	1.55	0.132	2.6	3.73	<0.001
Receptive: Spatial/Temporal Concepts	7.3	0.44	7.84	0.41	8.4	0.41	0.5	0.99	0.330	0.5	0.98	0.336	1.1	2.00	0.056
Listening Comprehension A	2.3	0.47	2.19	0.45	n/a	n/a	-0.1	-0.25	0.808	n/a	n/a	n/a	n/a	n/a	n/a
Parallel Sentence Production	16.2	1.05	23.4	0.99	23.7	0.99	7.2	5.49	<0.001	0.3	0.21	0.839	7.5	5.94	<0.001
Definitions	n/a	n/a	3.4	0.41	4.1	0.44	n/a	n/a	n/a	0.7	1.40	0.170	n/a	n/a	n/a

	Preschool		Kindergarten		First grade		Kindergarten-Preschool			First grade-Kindergarten			First grade-Preschool		
Verbal Analogies	8.5	0.45	9.5	0.42	9.5	0.42	1.0	1.92	0.065	0.0	-0.05	0.964	1.0	1.96	0.060
Expressive: Spatial/Temporal Concepts	5.3	0.49	6.6	0.46	6.9	0.46	1.3	2.20	0.036	0.3	0.55	0.587	1.6	2.84	0.008
Storytelling	2.7	0.37	3.3	0.35	n/a	n/a	0.6	1.53	0.146	n/a	n/a	n/a	n/a	n/a	n/a
Rapid Object Naming	182.0	15.00	137.1	14.16	98.6	14.26	-44.9	-2.39	0.023	-38.5	-2.18	0.038	-83.4	-4.65	<0.001
Rapid Color Naming	183.7	15.60	136.4	14.70	90.8	14.80	-47.3	-2.43	0.022	-45.6	-2.48	0.020	-92.9	-4.99	<0.001
Word Retrieval	9.3	1.50	11.6	1.40	13.6	1.50	2.3	1.23	0.229	2.0	1.12	0.272	4.3	2.35	0.027
Sounds in Words	32.3	1.00	31.7	0.95	34.1	0.95	-0.6	-0.49	0.627	2.4	2.09	0.046	1.8	1.54	0.134
Complex Speech Production	6.6	0.64	8	0.60	8.3	0.60	1.4	1.73	0.094	0.3	0.40	0.693	1.7	2.20	0.036
Pseudoword Repetition	8.2	0.30	9.6	0.28	10.0	0.29	1.4	3.49	0.001	0.4	1.34	0.191	1.8	4.96	<0.001

* Estimated mean with least square method. ** S.E. stands for standard error. *** Diff is difference between two estimated means. The p-value is calculated based on least significance difference method.

CHAPTER 4
DISCUSSION

The purpose of this study was to determine the efficacy of the Language, Learning, and Literacy Diagnostic Assessment (L3) for examining spoken and written language, and speech production skills at three levels of linguistic development: preschool, kindergarten, and grade one. Specifically, this study was completed to determine if the L3 instrument differentiates between the performance of these children at three different levels of linguistic development. A variety of tasks were used to conduct measurements in each skill area. These data should be useful in identifying children at risk for written language, spoken language, and speech production skills.

Overall Findings

Total L3 Composite

Analysis of the mean scores for each group revealed that the first grade and kindergarten group performed significantly better than the preschool group, whereas no significant difference was noted between the mean scores for the kindergarten and first grade group. This indicates that, on average, the children in first grade and kindergarten group are substantially more adept at the components of spoken language, written language, and speech production tested in the L3 than the preschool children. In order to address the reason for the lack of differentiation between the kindergarten and first grade group on the total composite score an analysis of their performance on the written language, spoken language, and speech production composite needs to be completed. This analysis revealed that the first graders did not differ significantly from the kindergartners on any of the three composites, written language, spoken language, or speech production. When we examine the children's scores across the grades, we see that preschoolers and first graders are consistently different and the kindergartners perform significantly better than the preschoolers on two of the three composites (i.e., written language and spoken language). The following section will address the tests that were most successful and least successful in differentiating the performance of kindergarten and preschool children; preschool and first grade children; and kindergarten and first grade children. Because the sample size was small, we considered the subtests that **best** differentiated the groups to be significant at a p-level of ≤ 0.001.

Comparison of Preschool Performance across Subtests

Assessment of pre-literacy and written language

Nine of the subtests in the Written Language domain differentiated the kindergarten and first grade group from the preschool group at a p-level of $\leq .001$ or smaller. On the Letter Recognition, Letter Naming, Concept of Word, Rhyme Recognition in Words, Rhyme Odd Man Out: Auditory-Visual, Rhyme in Story with Nonsense Words, Alliteration Odd Man Out: Auditory-Visual, Elision, Phonics Principles, Parallel Sentence Production, and Pseudoword Repetition subtests the kindergarten and first grade group performed significantly better than the preschool group.

The subtests of Letter Recognition, Letter Naming, and Phonics Principles require knowledge of the *alphabetic principle*. The Letter Recognition subtest measures the child's ability to point to a letter requested by the examiner. The Letter Naming subtest measures the child's ability to name a series of uppercase and lowercase letters.

The Phonics Principles subtest measures the child's ability to name the phoneme (i.e., letter sound) that corresponds with a specific grapheme (i.e., letter). Though many kindergarten children are able to recognize some letters, write random strings of letters, and use invented spellings (Snow, Burns, & Griffin, 1998d), they are typically at the emergent stage in these areas. Kindergartners and first graders have had one- and two-years respectively of training in concepts of the alphabetic principle. As children enter school with varying levels of literacy preparation, the formalized and continuous training in kindergarten and first grade should function to equalize and enhance the knowledge base about print related concepts across the children in each grade. Additionally, Adam (1990), Scarborough (1998), and others have underscored the importance of letter identification as a precursor to adequate reading skills.

The Concept of Word subtest measures the child's familiarity with books (i.e., left-to-right orientation, pointing to words, etc.). Children's awareness of the phonemic constituents in spoken language has been found to facilitate later reading ability (Morris, 1992). The concept of word task assesses phonological awareness at the word level for children who are not yet consistently matching speech-to-print. Phonics based skills and phonological awareness can be bidirectional in that as children become more proficient with mapping phonemes onto graphemes while reading, this will increase their skill in identifying words as separate units with the context of sentences Therefore, children with little knowledge of sound-letter associations, such as preschoolers, may find a task such as concept of word more difficult.

Phonological awareness is an important aspect of learning how to read (Goswami & Bryant, 1990; Goswami & Bryant, 1992, etc.). Tasks of rhyme and alliteration are some of the most frequently used measures of phonological awareness. It should be pointed out again that these are not tasks of phonemic awareness because they do not require explicit phoneme manipulation. The Rhyme Recognition in Words subtest measures the ability to identify if two spoken words rhyme. The Rhyme Odd Man Out: Auditory-Visual subtest measures the child's ability to identify the picture with a name that does not rhyme with the names of the other pictures in the group. The Rhyme in Story with Nonsense Words subtest measures the child's ability to generate a rhyming word with either a real word or nonsense word, for each test sentence read to the child. The Alliteration Odd Man Out: Auditory-Visual subtest requires the child to identify the picture with a name that does not begin with the same sound as the other pictures in the group. Rhyme and alliteration are components of phonological awareness which require the ability to parse syllabic units of words while holding these lexical units in phonological memory. These types of tasks, when conveyed using speech, are facilitated by adequate speech perception skills. Speech perception is thought to be one of the key mechanisms by which mental representations of abstract phonological structures are created (Rayner, Foorman, Perfetti, Pesetsky, and Seidenberg, 2001). The process of speech perception is believed to undergo refinement well into the stage in which children are exposed to writing (Rayner, Foorman, Perfetti, Pesetsky, and Seidenberg, 2001). Gerken's (1994) research, however, indicates that reliable discrimination between minimal pairs (e.g., words that differ by only one phoneme and have the same rime, e.g, tan-dan), may not be established until a child is five years old. Additionally, rhyme identification tasks and rhyme oddity tasks completed by 4-, 5-, and 6-year-olds indicated that all children were able to complete the tasks, however, the older children performed much better than the younger children (Goswami & Bryant, 1990). These findings may explain the significant difference seen between groups on subtests of Phonological Awareness concepts.

The Elision subtest measures the ability to repeat a word and then produce a part of that word after leaving out a specific syllable or phoneme. This syllabic and phonemic manipulation task has been administered by a number of researchers (CTOPP; Wagner, Torgeson, & Rashotte, 1999; Rosner & Simon, 1971) because of its high correlation with later reading ability (Scarborough, 1998). Elision is one of the most frequently used tasks in early reading assessment batteries. At the preschool level, many children are just beginning to attend to the earliest forms of phonological awareness (Goswami & Bryant, 1990; Snow, Burns, & Griffin, 1998d), so it is not surprising that this task differentiated the preschooler group from the kindergarten and first grade group.

Assessment of spoken language

Parallel Sentence Production examines a child's ability to use a variety of Amorphological and syntactic structures when given a verbal and visual cue. Children’s grammatical knowledge in their native language is fairly mature by the time they enter school (Rayner, Foorman, Perfetti, Pesetsky, & Seidenberg, 2001). Preschool children are still acquiring morphological inflections and constructions (Brown, 1973). The significant difference between groups was consistent with Brown’s (1973) developmental organization of early morphemes. Passives (i.e., a grammatical construction in English used to highlight the object of a sentence or the recipient of an action), coordinations (i.e., morphological combinations that can involve two or more sentences connected by conjunctions), and relative clauses (i.e., clauses used to specify information about an object or person) usually develop later in preschool children. These later acquired morphological constructions may be a primary reason for differences between the groups on the task of Parallel Sentence Production.

Pseudoword Repetition is a subtest in the Speech Production domain and it measures the ability to hold novel linguistic information in working memory long enough to repeat it verbatim. Phonological working memory is important in creating phonological representations (Cowan, 1998) which are important in the acquisition of vocabulary and for comprehension of speech and text. The development of automaticity for reading nonwords may be parallel to their development of skills in repeating nonwords. Children's acquisition of phonological representations and knowledge of letter and word predictability in text may be the reasons that the kindergarten and first grade children perform better on tasks of nonword repetition than the preschool children . In addition, research indicates that phonological working memory plays an important role in reading development (Cowan, 1998) and spoken language acquisition. Phonological working memory seems to be fostered by strong speech production skills as an individual can typically recall as many verbal items of a specific type that s/he can repeat in two seconds (Baddeley, Thomson, & Buchanan, 1975). This gives some credence to the belief that adequate speech production skills facilitate the development of stable phonological representations.

First Graders Compared to Kindergartners and Preschoolers

Visual Matching, Alliteration Odd Man Out: Auditory-Visual, Receptive Vocabulary, Morphological Familiarity, Rapid Object Naming, and Rapid Color Naming are the subtests that the first graders performed significantly better than preschoolers at a p-level of $\leq .001$.

The Visual Matching subtest, in the written language domain, measures the child's ability to detect two identical letters or numbers, or strings of letters or numbers. Rapid visual scanning is necessary for discriminating between print stimuli. Morris (1992) hypothesized that children attend to words holistically initially as evidenced by studies analyzing concept of word skills. Their increased speed of processing may explain their better performance than younger children on this task.

The Alliteration Odd Man Out: Auditory-Visual, in the domain of written language, measures the child's ability to identify the picture with a name that does not begin with the same sound as the other pictures in the group. As mentioned in the previous discussion, rhyme and alliteration are just being acquired by children in preschool. The question is then, "Why in this task of alliteration is there no difference between the kindergarten and preschool groups?" Although many kindergartners are taught the fundamental aspects of the alphabetic principle, they, for the most part, are not learning to read. Children typically begin reading in the first grade. It is likely that the use of pictures in this task to decrease memory load also decreased the variation between the kindergartners and preschoolers. This finding suggests that the first graders are truly proficient in the task of alliteration.

The Receptive Vocabulary task, in the domain of spoken language, measures the child's ability to identify nouns and verbs displayed in a picture format. Vocabulary development is highly contingent upon environmental exposure (i.e., family trips, reading books, etc.) and therefore varies greatly across individual children (Snow, Burns, & Griffin, 1998d). Because 'exposure' is such an important factor in vocabulary acquisition, perhaps once children begin receiving formal instruction the variability decreases at least in the earlier grades. However, when children enter the stage where they are reading to learn (Chall, 1983), it is expected that variability related to skills in language form, content, and use would again be seen among individuals. In fact, this explanation is consistent with Scarborough and Dobrich's (1990) illusory recovery hypothesis.

The Morphological Familiarity subtest is a receptive language task in the spoken language domain that measures the child's ability to judge the syntactic accuracy of a sentence. Hirsh-Pasek and Golinkoff (1996) found that 17-month-old children are capable of using word order to comprehend utterances containing many words. Because children at such an early age acquire this skill, then it is not surprising that preschoolers and kindergartners performed similarly on this task. The difference between first graders and preschoolers may be due to the first graders experience with sentence comprehension at the text level. Experiences with written language text may facilitate comprehension of the utterance in spoken language.

The subtests of Rapid Object Naming and Rapid Color Naming, frequently used spoken language tests for automatized naming, measure the child's ability to retrieve linguistic information from long-term memory. Rapid naming is a visual and phonological processing task (Wolf and Bowers, 2000; Wolf, Bowers, and Biddle, 2000) which is believed to be facilitated by stable and easily accessible representation of the pronunciation of familiar color, number, letters, etc. Since it is likely that older children have encountered items in rapid naming tasks more often than younger children, then it is not surprising that up to a certain age, rapid naming times (i.e., greater speed) would decrease. Additionally, processing speed in general is a developmental skill and should be reflected in children's performance across a range of linguistic and nonlinguistic task.

Kindergarten Comparisons to Preschoolers and First Graders

On three subtests, Invented Spelling, Sight Word Recognition, and Nonsense Word Decoding, first graders performed significantly better than kindergarteners at a p-level of $\leq .001$.

The Invented Spelling subtest measures the child's ability to spell words using phonemic knowledge. Invented spelling facilitates acquisition of basic phonics skills by developing understanding of the identity and segmentation of speech sounds and letter-sound relationships (Snow, Burns, & Griffin, 1998a). Since phonemic awareness skills develop concomitantly with phonics skills, kindergartners, who are just learning the conventions of print, are expected to perform more poorly than first grade children..

The Sight Word Recognition and Nonsense Word Recognition subtests measure early reading competence. The Sight Word Recognition subtest measures the child's ability to read a list of 14 common and age-appropriate words. The Nonsense Word Decoding subtest measures the child's ability to read decodable words. As children become familiar with letter-sound associations and are exposed to words in isolation and text, their sight word skills and word decoding skills increase (Adams, 1990). The difference in performance between the kindergarten group and first grade group is most likely due to the kindergartners emerging decoding and word recognition skills.

In summary, the lack of formal instruction in reading for many preschoolers is likely to be one explanation for the variation in the groups' performance across grade levels. The other, more likely, explanation is simply one of developmental readiness to process language proficiently and along with exposure to enriched spoken language. Rayner, Foorman, Perfetti, Pesetsky, and Seidenberg (2001) defined reading as the acquisition of the meaning of the words based on one's knowledge of the meaning of those words from spoken language. This definition underscores the bidirectional relationship between spoken and written language.

Subtests that Did Not Differentiate between Groups

No differences were found between the groups on tests of Letter Discrimination, Identifying the Beginning and Ending of Sentences, Name Writing, Copying Geometric Forms, Copying Letters, Lexical Order, Receptive: Spatial-Temporal Concepts, Listening Comprehension, Definitions, Verbal Analogies, and Storytelling.

The Letter Discrimination subtest measures the child's ability to discriminate between figures which are letters and those which are not letters. This subtest was only administered to children in kindergarten and preschool. Perhaps this task was too simple and/or needed to be administered to the first grade group in order for a differentiation between groups to be observed.

The Identifying the Beginning and Ending of Sentences subtest measures the child's ability to mark the beginning and ending of a sentence. If the child could not identify the beginning of the sentence when the examiner said, "I want you to point to the beginning of the sentence," then the examiner would say, "I want you to point to the first word in the sentence." This concept of print task (Morris, 1992) may have differentiated the groups if the children who needed to hear 'first word' in order to complete the task accurately were not given credit. The authors of the L3 need to explore this issue further.

The Name Writing subtest requires the child to write his or her name on a sheet of plain paper and then identify each letter in the opposite direction in which they written. Most children between three and four years of age are able to identify 10 alphabet letters and especially those in their names (Snow, Burns, Griffin, 1998d). This task appeared to be too simple as all children in the preschool and kindergarten group with the exception of one preschooler received full credit (i.e., one point) for the task.

The Copying Geometric Forms and Copying Letters subtest from Graphic Concepts measure the child's ability to copy shapes such as a circle, square, diamond, and a diamond containing a square and the child's ability to copy four uppercase letters: E, V, M, Z respectively. The lack of differentiation between the groups appeared to be due to the fact that items were not developmental in their complexity thereby yielding similar scores for the three groups of children.

Though it is possible for a preschooler to have a vocabulary repertoire as extensive as that of a kindergartner or first grader, research indicates that the lexicon of most preschoolers' is not as expansive (Owens, 1996). This difference in vocabulary development is likely to explain the significant differences among the three groups on several of the subtests of Receptive Language, Expressive Language, and Naming.

The Lexical Order and Receptive: Spatial-Temporal Concepts subtests, domains of spoken language measure respectively the child's ability to comprehend simple and complex sentences and the child's ability to comprehend spatial and temporal relationships. Both subtests of receptive language contained basic spatial and temporal concepts, so perhaps the two should be combined. In addition, the items did not differentiate the between the groups. As mentioned earlier, most preschoolers are just beginning to understand passives, relative clauses, and coordination (Brown, 1973), so perhaps the items in the revised subtest should include a few items containing these more complex morphological constructions.

The Listening Comprehension subtest measures the child's ability to comprehend a short story as measured by his or her ability to answer two factual and two inferential questions about that story. This subtest was only administered to the preschool and kindergarten group. Perhaps a comparison across the three groups would have shown developmental differentiation. It is possible that adding more questions or including two stories versus one story may have differentiated the groups.

The Definitions subtest examines the ability to define words (e.g., *lamp*, unhappy). The scoring of this subtest should be revised so that syntactic structures used in the defining of words would be taken into account. This type of revised scoring criterion should result in developmental distinctions between the groups.

The Verbal Analogies subtest measures the child's ability to use knowledge of word associations to deduce the appropriate answer in a simple analogy. It was expected that this test would have differentiated between the groups. The items on this subtest appeared to be too simple; more complex analogies should be included.

The Storytelling subtest measures the ability to tell the story depicted by a series of picture cards using age-appropriate vocabulary and syntax . The Storytelling subtest using the cards for *Tina's* Truck was only administered to the preschool and kindergarten groups. Perhaps a comparison across the three groups would have shown differences in storytelling skills. The current scoring rubric awards one point for each of the following components if present in the children's description of the pictured sequence: a) describes each of the four pictures, b) uses two specific nouns (e.g., truck, car, wheel, etc.), c) uses two specific verbs (e.g., picked [up], broke, etc.), and d) each sentence produced was age-appropriate semantically and syntactically. The scoring rubric may need to be more stringent in examining story grammar components in order to capture differences between grade levels.

Hypothetical and Real Profiles Based on L3 Subtests

Below is a chart which depicts hypothetical profiles that might be generated when the L3 is given to children with different language profiles. A sample child with a *specific language impairment* (SLI), *developmental dyslexia*, and an *expressive phonological impairment* are provided to highlight the potential differential diagnostic features of this tool. In addition, profiles from three of the participants in this study with suspected written language, spoken language, and speech production weaknesses are included in the chart. Profiles of a typically developing child and a child who is above average in the language and speech domains are included.

SLI is a classification given to a heterogeneous group of language disorders that are idiopathic in nature and manifest in difficulty learning language that is not a consequence of intellectual, sensory, or emotional problems (Bloom, 1988; Leonard, 1998). Most SLI children are late in acquiring single words and early syntactic constructions, and have difficulty retelling narratives and using several finite verb-related morphemes in obligatory contexts and in the nonword repetitions (Tager-Flusberg & Cooper, 1999; Stothard, Snowling, Bishop, Chipchase, and Kaplan, 1998). An SLI child would be expected to have difficulty with a number of subtests in the Written and Spoken Language domain, as well as with the Pseudoword Repetition subtest in the Speech Production domain.

Developmental dyslexia is the most prevalent specific learning disability and is characterized by a discrepancy between intelligence and reading aptitude (Lyon, 1995). Children with developmental dyslexia show depressed word decoding/word recognition skills but relatively unimpaired listening and reading comprehension (Gough and Tunmer, 1986). Deficits in subtests of rhyming and alliteration in the Written Language domain; Parallel Sentence Production and Naming in the Spoken Language domain; and Pseudoword Repetition in the Speech Production domain would be expected to be observed in this population.

Children with "pure" phonological disorders present with adequate visual and hearing acuity, normal intellectual abilities, and no signs of significant structural abnormalities or neurological dysfunction (Roth & Worthington, 2001). Phonological disorders are language-based speech disorders (Bleile, 1995) and are characterized by the child's systematic substitutions, omissions, and/or additions of a specific sound or sounds (e.g., fronting, depalatization, etc.). A child with this profile may have difficulty with the subtests of Phonological Awareness and Phonemic Awareness in the written language domain; Parallel Sentence Production, Morphological Familiarity, and Naming in the spoken language domain; and all of the subtests in the speech production domain.

Participant A's (child in this study) Written Language composite demonstrates particular difficulty with phonological awareness tasks in the written language domain, and with many of the subtests in both the spoken language and speech production domains. This child's profile is similar to that of the *expressive phonological impairment* profile.

Participant B had great difficulty with subtests in the written language domain and some difficulty in the spoken language and speech production domain. This child's profile is similar to that of the *SLI profile*.

Though Participant C's scores fall within the average range, it is noted that he had substantial difficulty with the Phonological Awareness concepts in the written language domain. In addition, when testing, this participant required frequent breaks unlike his peers. In fact, most of the time, this child could not sustain his attention to tasks for more than15-20 minutes. This child's profile is similar to that of the *developmental dyslexia profile with a possible co-morbid attention deficit*. However, as stated above the environmental factors and other variables must be considered as well as careful monitoring of his literacy development before this diagnosis is certain.

Profile D is that of a child who appears to be *advanced* in the domains of written language, spoken language, and speech production. Profile E is that of a child who appears to be developing normally at an *average rate* across the domains of spoken language, written language, and speech production.

Interestingly, many of the participants with profiles indicative of a spoken language, written language, or speech production impairment also had history of ear infection as well as familial aggregation of some form of language or speech disorder as indicated on the family questionnaire described in chapter 2.

Table 4.1. Hypothetical and Real Profiles of Children's Performance on the L3

	Total Composite	**Written Language Composite**	**Spoken Language Composite**	**Speech Production**
L3 Data for Prechool Children				
PreK Mean:	232.9	106.7	79.2	47
PreK SD:	54.6	41.4	10.9	4.44
PreK Range from SD:	178.3-287.5	65.3-148.1	68.3-90.1	42.56-51.84
PreK Minimum Score PreK Maximum Score	168 316	55 172	59 95	37 52
Hypothetical Cases				
Specific Language Impairment in a PreK child	170	65	59	42
Developmental Dyslexia in a PreK child	182	59	82	41
***Expressive Phonological Impairment in a PreK child	167	65	72	30
Real Cases				
A) PreK Participant with suspected written, spoken, and speech production impairment	169	73	59	37
B) PreK Participant with suspected **written** and **spoken** language impairment	168	55	71	42
C) PreK Participant with suspected **written** language impairment	188	69	73	46
D) PreK Participant with **above average** language and speech abilities	316	172	92	52
E) PreK Participant with **typical** language and speech abilities	243	117	77	49

Strengths of the Study

Many of the preschool children were tested in their homes or in an office at a private practice. This setting allowed the examiner to interact with the parents more extensively. The parents of the preschoolers often commented that their child was excited about participating in the study and that the child would frequently ask if and when the next testing session would occur. In addition, the examiner noted that many of the children seemed genuinely interested in the test and were eager to participate. In fact, one child wanted to continue testing longer than the allotted testing times on each of the three days that the test was administered.

Based on the comparative data, it appears that the tool differentiates first graders from preschoolers on the total composite, written language composite, spoken language composite, and the speech production composite. The kindergartners performed significantly better than the preschoolers on the total composite, written language composite, and spoken language composite.

The family questionnaire provided important demographic information which was substantiated by a plethora of other studies/data (e.g., Catts, Fey, Zhang, & Tomblin, 2001) showing that demographic information, such as mother's highest level of education, is a key predictor in their children's literacy development. For this reason, it will be important to look at mother's level of education as an independent variable within and across groups. Another environmental factor of importance is socioeconomic status. Graves and Slater (1987) found that first graders in the higher SES bracket had a vocabulary that was twice as large as first graders in the lower SES bracket.

Justice, Invernizzi, and Meier's (2001) analysis of a number of diagnostic and screening tools for early literacy revealed that few instruments are available for preschool children, and that there are few screening tools available for children in kindergarten. This makes it difficult to determine 1) if a more comprehensive evaluation is necessary, and 2) exactly which area(s) needs to be assessed more thoroughly. Justice, Invernizzi, and Meier's (2001) state that many commercially available tools examine only a few discrete skill components, thereby requiring speech-language pathologists to combine tasks/subtests from other tests. The L3 is an attempt to provide the most sensitive subtests based on empirical evidence in one tool. The L3's assessment of emergent literacy in the preschool population includes, among other constructs, phonological awareness, print awareness (e.g., Letter Production, Graphic Concepts, etc.), and spoken language skills (e.g., Sounds in Words, Receptive Vocabulary, Parallel Sentence Production, Storytelling, etc.) as recommended by ASHA (2001).

Berninger, Stage, Smith, and Hildebrand (2001) developed a three-tier model for reading and writing intervention. This model outlines specific constructs which should be tested at each grade level to determine if adequate reading and writing skills are being acquired. In kindergartners, skills in the orthographic (i.e., naming alphabet letters, letter identification accuracy, and letter identification rate), phonological (i.e., nonword memory, rhyming skills, and syllable segmentation), and rapid naming (i.e., rapid color naming and rapid object naming) should be tested. In first graders, skills in the orthographic (i.e, alphabet task), phonological (i.e., phoneme segmentation), rapid naming (i.e., rapid letter naming and rapid number naming), verbal intelligence (i.e., expressive vocabulary skills), word-specific reading accuracy and rate (i.e., single word reading and real word reading), and pseudoword reading accuracy and rate (i.e., single word decoding and pseudoword efficiency) should be evaluated.

The L3 also included subtest which contained recommended tasks from ASHA's (2001) recent guidelines in the areas of phonological awareness (e.g., Rhyme Odd Man Out: Auditory-only, Elision, etc.), rapid naming, phonological memory (e.g., Nonsense Word Repetition, etc.), letter identification, invented spelling, reading (e.g., real word, nonsense word, Spelling Recognition, etc.), and spoken language (e.g., Definitions, Word Retrieval, Verbal Analogies, Listening Comprehension, etc.). Consideration of the proposed bidirectional relationship between spoken language and written language is important to identify spoken language difficulties which may be precursors to or related to later written language deficits (Catts, Fey, Zhang, & Tomblin, 2001).

ASHA (2001) charged speech-language pathologists with early identification of language-based difficulties that put young children at-risk for literacy problems. Children who have difficulty with reading acquisition often have a history of spoken language disorder (Bishop & Adams, 1990). This tool assesses components of language in which speech-language pathologist are uniquely trained. Therefore, the speech-language pathologist should be able to make more distinct diagnoses by differentially diagnosing within and across the spoken language, written language, speech production domains.

Limitations of the Study

One of the challenges of an early intervention tool is to include the most sensitive tests for the construct (i.e., spoken language, etc.) being tested (Catts, Fey, Zhang, & Tomblin, 2001). The overall results of the L3 indicate that this diagnostic tool does differentiate two developmental groups from the younger of the three groups. However, correlations between subtests are necessary to determine which subtest are the more sensitive within and between the domains of spoken language, written language, and speech production. This study needs to be replicated in order to test the reliability of the tool. For validation of the L3, an item analysis of each subtest needs to be conducted. An item analysis is necessary in determining if the items in a subtest were too difficult or easy. This information would facilitate optimally effective decisions for revising items to increase differentiation of children children's skills across grade levels.

In this study, external validity was compromised due to small sample size and limited representation of other regions and cultures (convenience sampling). Future studies need to consider a broader socioeconomic status, children in different regions, and American children from other ethno-cultural backgrounds. In addition, a larger sample of typically developing children, and children with speech and/or language impairments needs to be included. Regression to the mean may have occurred because the sample consisted primarily of typically developing children. Data on both homogeneous and heterogeneous groups are necessary to facilitate distinct differential diagnoses of various speech and language disorders.

Future Research

Observations were made by the examiners while administering the tool which will be important factors to consider in the tool's revision. In the Letter Discrimination subtest, many preschool children confused letters with numbers. One child when looking at the number four stated, "That is a number," and still indicated that it was a letter, so the fine categorical distinction was not there.

On the Beginning and Ending of Sentences subtest, all children with the exception of one preschooler could identify beginning of a sentence when the term 'first word' was used. Perhaps as mentioned earlier, the children should have only been given credit if they identified the beginning of the sentence when the word 'beginning' was used.

It was noted that on the Alphabet Knowledge subtests (i.e., Letter Recognition, etc.), many of the preschool children labeled unfamiliar letters as other letters, simply said I don't know, or assigned non-letter sounds to letters with which they were not familiar, whereas many kindergarten and first grade children labeled unfamiliar letters as other letters and assigned the sound of another letter to a letter with which they were unfamiliar. This clearly implies that the categorical distinctions for sound-letter correspondences narrow as children progress through the early stages of literacy acquisition.

On the Concept of Word subtest, it appeared that if a child was not demonstrating some aspects of conventional reading that s/he had great difficulty pointing to each word and reading the sentences simultaneously; however a few children could recall the sentences verbatim or almost verbatim without pointing accurately.

The rhyme and alliteration subtests appeared to be very difficult for most preschool children and some kindergarten children. The L3 contains many rhyme subtests which may have been frustrating for children who have not mastered that concept.

It was observed, and then later confirmed by comparative statistics, that children in all groups performed better on the subtests of rhyme and alliteration when a visual-auditory format versus an auditory-only format was used. This phenomenon may be related to a reduction in the load on phonological working memory.

Of the three Speech Production tasks, the Complex Speech Production task appeared to be the most difficult. This task required phonological working memory, adequate phonological representations, and accurate speech production. It was noted that the first grade group performed significantly better than the preschool group on this task which suggests that developmental changes may be the cause. Another plausible explanation is in Conrad's (1964) phonological similarity effect hypothesis which posits that memory is better for dissimilar sounding items than it is for similar sounding items. Perhaps older children develop strategies which alleviate the effects of this phenomenon.

Table 4.2 contains a list of recommended changes for the L3. These changes fall are organized into three areas 1) changes in format of test stimuli or response form; 2) changes in instructions to children and; 3) changes in construction of subtest or subtest items.

Table 4.2 Recommended Revisions for L3

	Recommended Changes in Format of Test Stimuli or Response Form
1	*Visual Matching*: stimuli need to be placed on separate pages or least there needs to be fewer stimuli per page
2	*Spatial-Temporal Concepts (E):* provide acceptable responses on score form
	Listening Comprehension: (1) stating the title of the story may facilitate story comprehension and (2) add examples of acceptable responses next to or under questions
3	*Rows of Stimuli* : A device that covers rows of stimulus items (like a rule-shaped too) should be used for all subtests given to preschoolers that require scanning across a horizontal rows of stimuli
4	*Receptive Language Tests* (Lexical-Order; Spatial –Temporal Concepts), the correct response should be indicated next to the item on the response score for ease of scoring
5	*Parallel Sentence Production:* (1) add example of acceptable responses next to or

	under each item (2) remove item #19 because it's a duplicate item
6	*Synonyms:* provide acceptable responses on score form
7	*Definitions:* provide acceptable responses on score form
8	*Verbal Analogies:* provide acceptable responses on score form
	Rapid Naming: should be administered last as it is most taxing and often children want to stop participating after this test
	Recommended Changes in Instructions to Children
1	*Spelling Recognition Test*: clarify instructions or change stimulus item #10
2	*Phonics Principles*: clarify whether or not name of the letter is stated when probing for the sound (often letter name give cues to letter sound)
3	*Verbal Analogies*: Provide instruction for eliciting responses for embedded items in this close procedure. For example. You ride in a car and you ______in a pool (must specify elicitation procedures such as "you do what in a pool?" vs. no prompting
	Storytelling: give children title of stories to help orient them to the story
	Recommended Changes in Construction of Subtests or Subtest Items
1	*Graphic Concepts: Geometric Forms and Letters*: This subtest needs to be revised so that it differentiates the levels of ability more distinctly
2	*Expressive Spatial-Temporal Test*: (1) change the format so that more than a yes/no response is needed so that the child's language spatial & temporal constructs can be better evaluated. Perhaps use pictures to depict the constructs and model the first response "In this picture, the car in under the house. In this picture ________________" (2) delete item #3
3	*Rapid Naming Test*: too difficult for the preschoolers. The color and object stimuli were appropriate but the task was too tedious. Reduce number of items on plate and perhaps require only one rather than two plates. Further, children were confused by the dog stimulus and often called it a wolf
4	*Lexical Order and Spatial-Temporal Concepts (R):* do not differentiate the groups. Need to add more difficult items and delete some of the easier items. Consider combining the two tests
5	Calculate a separate expressive and receptive language composite
6	Add a definitions subtest for preschoolers allowing for functions to be used to define objects
7	Add a synonym subtest for the preschoolers. Possible format would be to show them pictures of similar objects and ask if they are the same or different
8	Add test of sentence writing to dictation
9	Items for Verbal Analogies, Definitions, and Storytelling should be revised to reveal developmental distinctions between groups

Discussion Summary

The L3 differentiates younger children from older children as can be seen in the percentage of answers correct across composite scores and subtest scores. As shown inthe profiles above, it appears that the L3 is able to capture strengths and weaknesses across the three domains. Therefore, it appears that the L3 has the potential to provide clearer differential diagnoses than current instruments assessing written language, spoken language, and/or speech production.

The spoken language subtests provided the least differentiation amongst the groups, however the constructs examined may not differ significantly between children in preschool and kindergarten, or perhaps the items in the subtests did not adequately represent different developmental levels within in the construct of interest. The small sample size which affects the power is another factor to consider when determining why some subtests in the spoken language domain did not appear to differentiate the groups. Including more explicit metacognitive tasks such as the Morphological Familiarity subtest might better differentiate the language skills of kindergarten and first grade children.

The L3 is uniquely designed to be administered by speech-language pathologists. With this tool, professionals such as speech-language pathologists will be able to provide better clinical understanding of the interrelationships between spoken language, written language, and speech production as well as providing some methodologies for clinical treatment studies. With some revisions, this tool should be a valid and clinically useful instrument for examining spoken language, written language, and speech production in the early elementary years.

APPENDIX A
RELIABILITY BY CONSENSUS

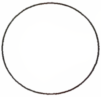
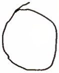
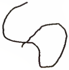
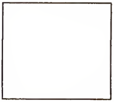
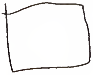
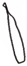
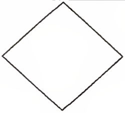
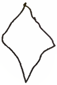
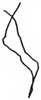
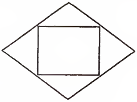
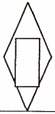
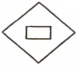
INVENTED SPELLING SUBTEST

The examiner asked the child to spell:	0-points	1-point	2-points	3-points	4-points	5-points
1. ball	A, l	B	Ba, bal, bol, baul, bale, boyl	boll		Ball
2. hide	I, d	H, ht	hd, ha, hi	Hid, had, hod, hoyd	Haide, hied, hiyt	Hide
3. jack	A, k	J, g	Jk, jc	Jek,jec, jck	Jac, jak, gak, gack	Jack
4. drum	U, m	D, j, g	Dm, jm, gm, gar, m, jorn	Jum, drm, jram, jrm, gum, grm, drourn	Jrum, drumb, grom, jrom, jrum	Drum
5. stop	O, p	S, c, a	St, cp, sa, so	Stp, sdp, cop, sopa	sdop	Stop
6. plate	A, t	P, pe	Pl, pa	Plat, plet, pepd	Plait, plaid, playt, plleyt	Plate
7. boat	O, t	B, bd	Bt, bo	Bot, boot	Bote, boet, bowt	Boat
8. tail	L, a	T, te	Tl, ta, tao, tau	Tal, tial, tay, tel	Tael, tayel, tayul, tayl	Tail
9. jumping	M, i	J,g	Jm, jp, jap	Jup, jumn	Jumpn, jumpen, jumpin, jubing, juping	Jumping
10. picked	K, d	P, po	pk, pc, p, pit	Pic, pite	Pit, pikd, picd, piket, piced, picket	picked

Note: 1= first letter of the word
2 = two correct letters in order

3=three correct letters in order (usually a vowel present)
4= a)at least three correct letters in order & must have a vowel,
b)attempt to make the vowel long by adding a phonetically appropriate sound
c)must be phonetically appropriate event though it is not the conventional spelling
5=conventional spelling

SCORING SYTEM FOR GRAPHIC CONCEPTS
COPYING GEOMETRIC FORMS

	1 Point	0 Points
		
		
		
		

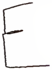
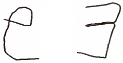
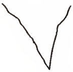
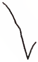
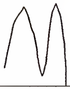
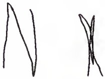
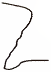
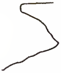
1 point

- Approximate shape
- Lines are uneven, wavy, imprecise

0 points

- No approximate shape.
- Not clearly recognizable as target shape

SCORING SYTEM FOR GRAPHIC CONCEPTS
COPYING LETTERS

	1 Point	0 points
E		
V		
M		
Z		

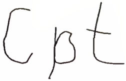
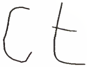
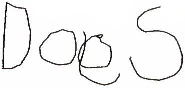
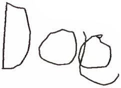
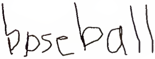
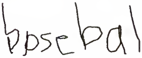
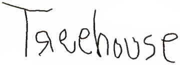
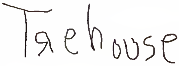
1 Point

- Approximate letter shape
- Lines are uneven, wavy, imprecise
- Approximate letter shape but letter is backwards
- No more than 2 letters can be backwards

0 Points

- Completely incorrect letter shape.
- Not clearly recognizable as target letter shape

SCORING SYSTEM FOR GRAPHIC CONCEPTS
COPYING WORDS

2 Points	1 Point	0 Points
Cat		
Dogs		
Baseball		
Treehouse		

2 Points

- Correct letter shapes
- Complete and accurate letter representations

1 Point

- Approximate letter shapes & correct number of letters
- Lines may be uneven, wavy, imprecise
- A maximum of 2 letters can be backwards (across all words)

0 Points

- Does not have correct letter shape and/or number of letters
- Not recognizable as target word

SCORING SYTEM FOR GRAPHIC CONCEPTS
COPYING SENTENCES

2 Points	1 Point	0 Points
I like toys	ILiKe toys	ILiK toys
I eat cake	I ept Cake	I eot CaK
The boy runs	The boy runs	The by runs
A dog barks	A dog bArks	A [illegible]tg bArks

2 Points

- Correct letter shapes, number of words, and spaces (3) in between words
- Complete and accurate representation of all words

1 Point

- Approximate letter shapes but correct number of words
- Letters may be uneven, wavy, imprecise
- Spacing between words may be incorrect
- A maximum of 4 letters may be backwards (across all words)

0 Points

- Does not have all correct letters in words
- Not recognizable as target sentence

LISTENING COMPREHENSION SUBTEST: BOBBY'S BALLOON (PRESCHOOL-KINDERGARTEN)

- On Saturday, Bobby went to the circus with his older brother, Jim.
- When Bobby arrived at the circus, Jim bought him a purple balloon.
- Jim tied the string from the balloon around Bobby's wrist.
- A few minutes later, Bobby's brother saw a purple balloon floating in the air.
- Bobby looked sad.

Questions	Acceptable Responses	Unacceptable Responses
1. What day did Bobby go to the circus?	Saturday	Wednesday, today, Friday, yesterday, with his brother, Sunday
2. Who took Bobby to the circus?	Big brother, older brother, Jim, his big brother	Big sister, his dad, his friend, Bob
3. Why did Jim tie the string from the balloon around Bobby's wrist?	So it won't fly away, not to fly away, so it won't go away, because it won't go away, so it won't float in the air, because it might go up in the air, so it wouldn't let go in the sky, so his balloon can't float away, so it wouldn't go away	To let it go
4. Why did Bobby look sad?	because he liked the balloon so much, he wanted the balloon back, his balloon floated up, because his balloon flew off his wrist, a purple balloon is floating in the air, because his balloon went away, he untied the balloon, because it flew away, he saw a purple balloon flying away, his balloon floated in the air and he wanted it back, he looked sad because his balloon floated away, cause his balloon was flying in the air	

LISTENING COMPREHENSION SUBTEST: JENNY'S JUNK (FIRST GRADE)

- Jenny wanted to blow bubbles and play with her dog, Kip.
- Before Jenny could play, she had to straighten her room and remove the trash from under her bed.
- Under her bed, she found crumpled paper, dirty clothes, and empty candy wrappers.
- Quickly, she took the junk from under her bed and placed it in her closet
- And then Jenny asked her mom to inspect her room.
- Jenny's mom looked shocked and disappointed when she looked in Jenny's closet.

Questions	Acceptable Responses	Unacceptable Responses
1. What did Jenny have to do before she could play?	Put all her stuff away Clean her room Clean up room	She had to clean out her closet Take out trash
2. What was under Jenny's bed?	Trash Crumpled paper Crumpled paper, dirty clothes, and empty candy wrappers Crumpled up paper	<respondent forgot>
3. Why was Jenny's mom shocked and disappointed ?	She put her stuff in the closet instead of somewhere else She didn't do what she was told to do Because she put all the stuff in her closet	When she looked into closet Because she looked at her room, and then she looked at her closet, and then when Jenny got home she said you have to clean your closet
4. Do you think Jenny got to blow bubbles and play with her dog? Why or why not?	No she didn't listen to her mom No, because she had to clean her closet now Maybe, because she may have or may not have cleaned out her closet	Not until she cleaned up her room No, she dog might knock bubbles out of hand

DEFINITIONS SUBTEST (KINDERGARTEN AND FIRST GRADE)

	Acceptable Responses	Unacceptable Responses
1. lamp	it's a light bulb, something around it, it makes stuff shine like the sun; something you turn on so you can see better, can turn on with hand or touch it, it goes on/off; make light, you can turn it on and off; lights house up, uses electric, need light bulbs; turn on light and see, has a light switch	
2. unhappy	where you're not very happy about what someone did or you're sad; when you are happy and smiling, then you are frowning and you're sad; when you're sad and don't feel happy; not happy, kind of angry;	when you're mad and you can't go to places
3. hospital	people take care of other people, if I had a heart attack put you in the ambulance take you to the hospital; where people go whenever they need doctors to help them; stay there and get …; a place you go when you are hurt; a place for people to go if hurt or sick;	when somebody broke their leg go to the hospital
4. excited	when you are happy someone spends the night at your house; happy, jump up and down; when you are glad something will happen when you are going to go someplace fun and you can't wait; you're like "oh yeah" act like your birthday is coming, you're happy	
5. hungry	where your mouth gets dry, your stomach growls, you need food; when you want to eat food; you want to eat food; when you want an apple or crackers, that means you're hungry	if you eat an apple then that wouldn't make you that much hungry

SYNONYMS SUBTEST

	Acceptable Responses	Unacceptable Responses
1. laugh	Gafaw, chuckle, giggle	Talk
2. silly	Goofy, funny, zany	
3. angry	Mad, upset	
4. sad	Unhappy	Frown, angry
5. big	Huge, humongous, gigantic	Medium
6. hit	Punch, slap	Push, sit
7. road	Highway, street	Dirt road
8. sleep	Nap, rest	Tired, sleeping
9. pretty	Beautiful, attractive	Cool, princess
10. write	Draw	Right, hand

VERBAL ANALOGIES SUBTEST

	Acceptable Responses	Unacceptable Responses
1. A cat has fur. A bird has _________(whole-part)	wings, feathers	beak
2. Dogs run. Fish_________. (agent-action)	swim	
3. You ride on a bike. You fly in an __________ (action-object).	airplane, blimp, plane, helicopter	nest
4. An elephant is big. A mouse is _______(antonym)	small, tiny, little	big
5. You write with a pen. You eat with a _________(function)	fork, spoon, chopsticks	
6. Fingers are on your hand. Toes are on your __________. (part-whole)	feet, foot, foots	skin
7. You sail on a boat. You _______ in a car. (action-object)	drive, ride	
8. The sun makes us hot. Snow makes us ______________.(antonym)	cold, chilly, freezing	snowman
9. You wear socks on your feet and a hat on your ______________.(function)	head	
10. You play the drums. You throw a _________ (action-object)	ball, baseball, basketball, frisbee, football, stick	party

STORYTELLING SUBTEST: TINA'S TRUCK (PRESCHOOL)

- Tina is playing with a truck
- She rolls it across the floor
- A tire pops off as she hits a bump on the floor
- Mom puts the tire back on the truck

	Talks about each picture	Uses two specific nouns	Uses two specific verbs	Each sentence is semantically and syntactically correct
1. She puts down a truck that's not broken. 2. Then she puts it down. 3. Then she broke it. 4. Then her mother fixed it for her.	0	0	1	1
1. She was playing with a truck. 2. And she still was. 3. And the tire fell off. 4. And another girl came and said, "Can I play with you?"	1	1	1	0
1. The girl is picking up the truck. 2. And she's playing with it. 3. The wheel broke. 4. And her momma fixed it.	1	1	1	1

STORYTELLING SUBTEST: TINA'S TRUCK (KINDERGARTEN)

- Tina is playing with a truck
- She rolls it across the floor
- A tire pops off as she hits a bump on the floor
- Mom puts the tire back on the truck

	Talks about each picture	Uses two specific nouns	Uses two specific verbs	Each sentence is semantically and syntactically correct
1. She picked up the car. 2. She put it on the ground really hard. 3. And she broke it. 4. Mom came and fixed it.	1	0	1	1
1. She was picking her car up then the she put it back down. 2. The wheel came off. 3. Her mom fixed it.	1	1	1	1
1. She got her car 2. Then she string it pulled her car. 3. Then it got broken. 4. Then her mom fixed it back up.	1	0	1	0

STORYTELLING SUBTEST: SAM'S SURPRISE (FIRST GRADE)

- Sam hopped in the back seat of the station wagon
- He colored a picture as he rode along
- As Sam's dad drove up to the pet store, Sam looked confused
- Sam's expression changed to glee as he jumped out of the car and got his first puppy

	Talks about each picture	Uses two specific nouns	Uses two specific verbs	Each sentence is semantically and syntactically correct
1. The kid is in the car. 2. He sees a pet shop and it's open. 3. He's writing in his book. 4. And he got a dog.	1	1	1	
1. The boy is in the car. 2. The boy is drawing. 3. The pet shop is open. 4. The boy gets a new puppy.	1	1	0	1
1. The boy went to the store and on the way he drawed and then he went to the pet shop. 2. And on the way he got a puppy.	0	1	0	0

APPENDIX B
CORRELATIONS

Table 3.50 Correlations Among L3 Composite Scores

	Total Composite	Written Composite	Spoken Composite	Speech Composite
Total L3 composite	1.000	.9842 <.0001	.8846 <.0001	.7098 <.0001
Written composite	.9842 <.0001	1.000	.7967 <.0001	.6554 <.0001
Spoken composite	.8846 <.0001	.7967 <.0001	1.000	.5957 .0002
Speech composite	.7098 <.0001	.6554 <.0001	.5957 .0002	1.000

Table 3.51 Significant Correlations of rho= .75 (p =<.01) or greater for the Written, Spoken, and Speech Composites and Subtest Scores Across Domains

Subtests	Written Composite	Spoken Composite	Speech Composite
Receptive: Letter-recognition	.890		
Expressive: Letter-naming	.874		
Letter Production	.883		
Concept of Word	.8376		
Rhyme Recognition in Words	.8790		
Rhyme Recognition in Sentences	.8226		
Rhyme Production in Words	.8852		
Rhyme Production in Sentences	.8561		
Rhyme Odd Man Out: Auditory-Visual	.8086		
Rhyme in Story with Nonsense Words	.8560		
Alliteration Odd Man Out: Auditory-Visual	.8477		
Elision	.8232		
Phonics Principles	.9020		
Receptive Vocabulary	.8155		
Parallel Sentence Production	.7750	.8739	
Total Sounds in Words			.8231

Table 3.52 Total Number of L3 Subtests that Correlated at ≤.01 and ≤.0001 with Written, Spoken, and Speech Composites

	Written	Spoken	Speech
≤.01 (significant)	30	30	31
≤.0001 (highly significant)	21	14	7

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I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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